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RESUSCITATION FROM ELECTRIC SHOCK.

The judgment expressed in the Electrical World in its issue of July 21st of this year, when announcing D'Arsonval's method of resuscitation from the apparent death that may follow an electrical shock, and the stress it subsequently laid upon the extreme importance of the matter, have received striking confirmation in the recent case at Pittsfield, Mass., where by its means a life was probably saved. The proof of the efficacy of this method is now so complete that no one following electrical pursuits in which there is danger from electric shocks, is justified in neglecting to make himself familiar with the D'Arsonval method of resuscitation. The necessary details have been given in practical terms by Dr. Goelet, only second in authority on the subject to D'Arsonval, in the valuable article printed several months ago in our columns, and which we reprinted in poster form for distribution. As an indication of the interest in the question among electricians, we may state that the first edition of the poster, consisting of 5,000 copies, has been exhausted, and an order for 500 copies has just been received from a large corporation for distribution among its employees. A second edition is now in press, and we shall be pleased to mail a copy to any of our readers upon application.

THE BOARD OF ELECTRICAL CONTROL.

The recent appointments of Mayor Gilroy to the Board of Electrical Control of New York City again directs attention to this worse than useless commission. From the beginning it has been a mere political machine; its origin, it is generally believed, was due to equivocal motives, and it signally failed in the chief object for which it was instituted—the placing of wires under ground, which was finally accomplished only through the personal efforts of Mayor Grant. There seems to have been no reason for extending the life of the Board other than for the purpose of retaining the offices for politicians, for every duty within its scope can be performed by its technical staff, Dr. Wheeler and Col. Kearney, under the direction of the Board of Public Works. In the proposed re-organization of the City Departments, the Board of Electrical Control should be one of the first to receive attention from the reformers, and be legislated out of existance, Col. Kearney whose competency is unquestioned, being transferred to the Board of Public Works. The following remarks by the New York *Tribune* are significant in view of the fact that two of the three members of the Board are of its political faith: "This Subway Commission has "been rotten with jobbery from its start. It has been filled with "political pets and parasites. The Mayor, by the appointments which "he announced yesterday, has not changed the general opinion that "the Commission is chiefly an embarrassment and obstruction and "a nuisance in public affairs in this town."

ELECTROCUTION.

In referring some months ago to the startling statement of D'Arsonval, that electrocution, as practiced in the New York State prisons, does not cause actual death, we remarked that this dictum, coming from such a source, could not be passed over lightly and should be tested by the state authorities at the first opportunity. We had in view the impression that would be created by such an authoritative utterance on the general public, and foresaw the opportunities it would afford to sensationalists. While we are opposed to the method of execution adopted as one abhorrent in its features and bringing discredit upon a great industry, yet we do not desire to have its repulsiveness increased in the minds of the public by the belief that, after all, real death is not produced by its application.

We therefore favor a scientific investigation not with any idea that the result will demonstrate that the criminal may be revived, but in order to definitely settle opinion on this point, and put an end to the deplorable sensationalism that the question has given rise to. We are, however, most decidedly opposed to placing the matter in the hands of those who are now exploiting it solely for the sake of a repellant notoriety which it would be shameful for the public authorities to gratify. The United States possesses a number of electro-therapeutists of high attainments and a committee selected from these should have charge of the investigation. We will repeat, however, that there is not the slightest probability that such an investigation would result in showing that an electrocuted criminal can be resuscitated. It is unbelievable that with the efficient arrangements in the New York prisons for subjecting the criminal for a long period to the terrific shocks of a high alternating E. M. F., there would not result lesions and destruction of nerve centres from disruptive stresses, and it should also be borne in mind that electrolytic effects may also be produced by the alternating current. Aside, however, from any hypothesis, the reports of post-mortem examinations of electrocuted criminals have shown that the death has been a true physiological one.

EFFICIENCY OF BOILERS AND ENGINES.

Elsewhere we print an instructive article by Mr. Geo. H. Davis on economy tests of electric railway plants, which enumerats the many details necessary in carrying out a complete test. We cannot agree, however, in the statement that we may expect in even the best of condensing plants an economy such as that indicated by the figures given. We do not mean to imply that such figures have not been reported as the results of tests, but we doubt very much if they can be obtained in power station work. An evaporation of 11.50 and 11.75 pounds of water per pound of combustible from and at 212 degrees corresponds to boiler efficiencies in the neighborhood of 77 and 78 per cent. respectively. The most authoritative boiler and engine tests recently made are those of the "Research Committee on Marine Engine Trials of the Institute of Mechanical Engineers," of which Prof. Kennedy is Chairman. In the tests of five sets of marine boilers the efficiencies were found to be 62, 62, 66.1, 67.2 and 69.2 per cent. respectively; the high efficiency in the latter case being due to the nnusual ratio, 75, of heating to grate surface. It may be said that the boilers tested were not of the tubulous type, but it is questionable if the efficiency of the latter exceeds that of marine boilers under the ordinary working conditions of both. We are inclined to think that the engine efficiency is also overrated by Mr. Davis. In the new United States men-of-war the best economy attained with their triple-expansion engines has been 1.9 pounds of combustible per hourly indicated horse power, excluding all expenditures for auxiliary machinery. In the British tests above referred to, the consumption of combustible per hourly indicated horse power of three triple-expansion engines tested was respectively 1.82, 1.76 and 1.49 pounds, and of three compound engines, 2.65, 2.33 and 2.30, all exclusive of coal expenditure for air, circulating and feed pumps. It is true that, with the exception of one case, these efficiencies are low, but they are nevertheless the result of tests of the utmost accuracy by entirely disinterested and thoroughly competent engineers, which three conditions are rarely satisfied in tests as usually made.

REACTANCE.

In our issue of October 20 we printed a translation of an article contributed to *L'Industrie Electrique* by Prof. Blondel, in which he objects strongly to the definition for reactance adopted by the American Institute of Electrical Engineers. The main objection urged was that reactance, like other electrical terms ending in *ance*, should be a constant of a circuit and not include the effects of phenomena exterior to that circuit. In the same issue Messrs. Houston and Kennelly point out that the degree of fixedness of reactance in a circuit is, in any event, considerably less than that of inductance, and resistance and suggest that all confusion can be avoided by specifying "equivalent reactance" and "equivalent resistance" for the particular cases of mutually inductive circuits. By the use of this phraseology, they believe, not only will the objections of Prof. Blondel be overcome, but no violence will be done to the definition adopted by the Institute, which coincides, as far as the use of the term "relative reactance" is concerned, with the opinion of Prof. Macfarlane, expressed by him in a letter that subsequently appeared in our columns. In the present issue we print a communication to the Institute *Transactions* from Messrs. Bedell and Crehore on the same subject, in which the broad definition of the Institute is upheld. It is shown that by the definition favored by Prof. Blondel, reactance is only a constant of a circuit when it contains no iron, and, moreover, that the equation offered by him in illustration contradicts the definition by including the effect of hysteresis which, not being a wattless component, would therefore make reactance contain an energy component. The conclusion arrived at by these authorities is similar to that to which Messrs. Houston and Kennelly and Macfarlane were led, and this com promise will, we feel sure, be received in France in the same generous spirit in which it is offered. Briefly, it is proposed to retain the fundamental definition of reactance in the general form adopted by the Institute; in the case of circuits containing no iron, reactance may be defined as proposed by Prof. Blondel; in the cases where counter E. M. F.'s other than those due to capacity and self-inductance are present, the term "equivalent reactance" may be used. As remarked by Messrs. Steinmetz and Bedell, the term "reactance" is a happy one, not only in significance but on account of its international form. While it might be desirable for it always to retain the simple meaning which it has in non-ferric circuits, its use would thereby be greatly abridged, and we would be deprived of a much needed term to designate the reactive effects most met with in practical work.

Executions by Electricity.

The London *Electrical Review*, referring to the announcement that Governor Flower will permit an experiment to be made in order to determine if a criminal executed by electricity can be resuscitated, says that it feels sure, however greatly the public may have been shocked at the first effort at electrocution, that this kind of thing will meet with general and real protestations of indignation. It is perfectly well known at the present day, it states, that death is made swift and sure by the application of the electric shock, and this suggested experiment seems to it not only perfectly unwarranted, but utterly repugnant to civilized notions. "It looks almost as if the Hon. Roswell P. Flower has been made the catspaw of certain medical men, who probably have only their own ends to serve, public feeling being dragged in so as to lend weight to the barbarous notion. To try to resuscitate a man who has accidentally become the subject of an electrical shock commends itself to everybody; but in this instance we are confronted with what may be a very questionable experiment. If the shock is properly applied for a definite time there can be no doubt that the criminal will be killed; but who is to say whether the shock will not be deliberately applied in such a manner, and during such an infinitesimal period of time, the probable chances are that life has not actually fled from the body of the poor wretch? What then would his recovery prove but that he wasn't dead? We have overwhelming proof, from the practical demonstrations already carried out in American prisons, that electrocution is a speedy and certain end; if, therefore, it is intended that it should be so, the resuscitation of the tortured criminal would merely show that it had not been properly carried out."

Discussing Papers.

A paper read before an Institution of standing, but inadequately discussed, may often do more harm than good.—London *Electrician*.

Where Is It?

An English writer refers to an American electric railway on which, he says, there are 20 short circuits per day on an average.

The American Institute of Electrical Engineers.

At the regular monthly meeting of the American Institute of Electrical Engineers on Wednesday, November 21, Prof. George D. Shepardson read a paper entitled "Suggestions for an Index to Engineering Literature." After outlining what has heretofore been done in this direction, the conclusion is arrived at that one of the first considerations in the compilation of an index is the cooperation of a large number of people.

An efficient plan will require the expenditure of considerable money and would probably not be self-supporting, and it is thought that such work could probably best be done under the auspices of some society or societies. Prof. Shepardson advocates the combination of various national engineering societies to maintain the publication of an index which might thereby be made of lasting value to the engineering profession of the entire world, and since the headquarters of four of the national societies of this country are in the same city and two of these in the same building, Prof. Shepardson believes that such cooperation would not be difficult.

A plan is offered to carry out the objects of such a cooperation as that proposed, and some suggestions are added as to the style of such an index. Prof. Shepardson thinks it should include subjects relating to electrical, mechanical, hydraulic and civil, and perhaps mining, engineering; it should index books as well as periodicals; the references should be descriptive as far as practicable; each subject should have a page by itself; digest and simple reference might be on separate sheets; references and sheets on each subject might be numbered consecutively for convenience in adding later notes from other files or from later publications of the same articles; abbreviations or other symbols should indicate whether the reference is to original papers or reprints, whether the paper is in full or in abstract, and whether accompanied by discussions, plates or illustrations; the subject sheets should be separate and perforated for rearranging and binding, and should be printed on one side only, and might be printed on cards such as are used in the card catalogues of libraries.

Communicated discussions were received from Mr. Carl Hering, Mr. J. Stanford Brown, Mr. Max Osterberg and Prof. Goldsborough, and Prof. Houston, Prof. Crocker, Mr. Edward Caldwell, Mr. T. C. Martin and Mr. R. W. Pope, participated in the oral discussion. The labor required to keep up a personal index and its cumbersomeness after a time were referred to, and it was pointed out that the requirements of a current index and a general or reference indexwere different and in some respects incompatible. All favored, however, the compilation of an engineering index somewhat after the plan proposed, though the difficulties in carrying it out were recognized as being not inconsiderable.

In a communication Prof. H. J. Ryan expressed his satisfaction with the Institute definition of reactance, and dwelt upon the fact that it separated the energy and wattless components of impedance and gave the impedance and reactance formulas the same form as ohm's law.

The Definition of Reactance.*

BY C. P. STEINMETZ AND FREDERICK BEDELL.

At the Philadelphia meeting of the American Institute of Electrical Engineers, May, 1894, the name "reactance" was officially adopted by the Institute and defined in accordance with a paper† on Reactance communicated by us and reprinted in most of the electrical periodicals. The action of the Institute was unanimous and its definition has met with general approval. Objection to it, however, has been raised in an article‡ recently communicated to a French periodical. Since we cannot agree with the arguments forwarded in this article, it will be in place for us to state our views thereon.

The definition of reactance adopted by the American Institute of Electrical Engineers is:

"Reactance is the component of electromotive force at right angles to the current, divided by the current."

By this definition the term reactance is the quotient of the reactive E. M. F. divided by the current, where the reactive E. M. F. includes all wattless E. M. F.s, whether due to inductance, capacity, polarization or counter E. M. F. of any kind, as of synchronous motors, and excludes all energy components, as would be introduced by motors, transformers, hysteresis, etc.

*From the November issue of the *Transactions* of the American Institute of Electrical Engineers. Communicated October 31, 1894.
†The Electrical World, June 30, 1894.
‡The Electrical World, Oct. 20, 1894.

In objecting to this definition, the writer referred to, takes a position essentially as follows:

(1.) The term reactance shall include the effects of self-induction and capacity only.

(2.) It should always be defined by the equation

$$I = \frac{E}{\sqrt{R^2 + K^2}};$$

Where: I = current;
R = ohmic resistance;
E = electromotive force;
K = reactance.

(3.) For harmonic currents

$$K = \omega L - \frac{1}{C\omega};$$

Where: L = self-inductance;
C = capacity
$\omega = \frac{2\pi}{T}$ = pulsation.

(4.) The term "reactance" has a right to exist only because it is a constant of the circuit. Defined, however, as the quadrature component of E. M. F. divided by the current, it is the complex resultant of different reactions and not a constant of the circuit. All terms in "ance" should denote constants of the circuit, and whenever used in a generalized meaning, an additional term should be added, as "apparent reactance."

We may state that when investigating the question of properly defining the term "reactance," we have fully considered the position taken by this writer. We have, however, come to the conclusion that his definition is not tenable, but is contradictory, for the following reasons:

(1.) Neither in the one nor in the other definition is "reactance" a constant of the circuit, except in circuits containing no iron. In reality, circuits nearly always contain iron, and in such circuits the reactance can be considered as approximately constant only in a very limited range. When extended over a greater range of E. M. F. or of current, the self-inductance, and thus the reactance, varies. The same applies to most of the other quantities ending in "ance," as impedance, reluctance, and permeance, and thus the statement that quantities in "ance" should be constants of the circuit, is against the adopted practice and not fulfilled by either definition.

(2.) Where iron is present, the statement for harmonic currents

$$K = \omega L - \frac{1}{C\omega}$$

contradicts the definition of K by the equation

$$I = \frac{E}{\sqrt{R^2 + K^2}}$$

R being taken by the ohmic resistance and K as reactance. This is due to the presence of hysteresis. These relations do hold in the absence of iron, and such cases were taken by us in our paper to illustrate the definition for simpler cases; the fundamental definition, however, should in our opinion be sufficiently general to include circuits with iron. Consider an harmonic current flowing in a circuit embracing iron; for simplicity assume capacity absent. The last equation would not give any direct relation between the inductance and reactance, such as would be obtained from the equation just preceding, but would make reactance still a more complex quantity, by including therein not only the effect of self-induction but that of hysteresis as well. Furthermore, it would lead to the result that the reactive E. M. F. is not wattless, but includes an energy component, an idea quite foreign to the term.

These considerations obliged us to discard any indirect definition of reactance by means of the term inductance, and to adopt the more direct definition analogous to the definition of resistance.

The definition of resistance is Ohm's law:

$$R = \frac{E}{I},$$

where E and I represent an unvarying E. M. F. and current, respectively.

Considering E and I as an harmonic electromotive force and an harmonic current—or in the case of alternating quantities which are not simple harmonics, as their equivalent harmonic values, that is, values of equal square root of mean square value and equal power—the above equation gives the definition of impedance:

$$\text{Impedance} = \frac{E}{I}$$

Our proposed definition for reactance is analogously written:

$$\text{Reactance} = \frac{\text{reactive } E}{I}$$

Further, we may define the equivalent resistance of the circuit by the expression

$$\text{Equivalent resistance} = \frac{\text{power } E}{I}$$

In the absence of expenditure of energy outside the electric conductor, this quantity coincides with the true ohmic resistance.

These quantities are thus defined directly, and in a uniform manner. How far these quantities are constants of the circuit depends upon the circumstances; in any case reactance and impedance depend upon the frequency.

The phenomena taking place in an alternating current circuit cannot fully be represented by the terms:—ohmic, resistance, inductance, and capacity, but a further term has to be introduced, representing the losses of energy outside of the electric conductor, as hysteresis, etc., and the most satisfactory way to do this appears to us to bet the generalization of the term "resistance" to "equivalent resistance."

The use of "equivalent" values for quantities is employed in the paper on "The Law of Hysteresis, III." In the discussion of this paper at the Philadelphia meeting the significance of these values is pointed out.

Wherever the reactance is generalized to include active counter E. M. F.'s, it may well be distinguished by the denotation "equivalent reactance."

We would emphasize the utility of two rectangular components, whether E. M. F.'s or currents are resolved. Reactance should always, in our opinion, be associated with that which represents no expenditure of energy, the reactive E. M. F. being at right angles to the current and the reactive current (the wattless current) being at right angles to the E. M. F. Whether we resolve currents or E. M. F.s' depends upon the problem in hand; each method has its advantages. If we resolve the current, we may write:

$$(\text{Current})^2 = (\text{power current})^2 + (\text{reactive current}).^2$$

Divided by E, this gives:

$$(\text{Admittance})^2 = (\text{conductance})^2 + (\text{susceptance})^2,$$

for a simple case; in general, for conductance and susceptance we should write equivalent conductance and equivalent susceptance. Admittance, conductance and susceptance as thus used are the inverse correspondents of impedance, resistance and reactance, and may be added as vector quantities. Many alternating current problems are much simplified by this treatment. It is important, however to employ components which are at right angles to each other, and for this reason the definition of the American Institute of Electrical Engineers seems preferable. It is in this point that the definition is fundamentally different from that of the French writer already referred to. In the absence of hysteresis losses, the definitions would be the same, applying the term equivalent reactance to the case where the counter E. M. F.'s other than those due to capacity and self-induction, are present. To conclude then, we may say that in the absence of iron we may define reactance in terms of inductance and capacity, as this writer has done, and as has been done by us in the illustrative examples in our paper; the fundamental definition, however, should, in our opinion, remain in the general form adopted by the American Institute of Electrical Engineers.

In a note to our original paper we have called attention to the first suggestion of the term reactance by M. Hospitalier in May, 1893, and the recommendation of the committee appointed by the Société Internationale des Electriciens to consider the programme for Chicago Congress, 1893. The term is a happy one; it is international, and uniformity in its use is to be desired.

In our opinion the best definition for "reactance" is that adopted by the American Institute of Electrical Engineers. In this, as in all matters, there is, however, room for difference of opinion. The reasons for thus defining the term have not before been published, but we believe that when they are duly considered, the action of the Institute will meet with International approval.

Agricultural Electric Railways.

A meeting was recently held at the office of the London Chamber of Commerce of those members of the chamber interested in the question of the construction of light railways for agricultural purposes in England; the meeting having been called together for the purpose of electing delegates to attend the conference which is to be held at the Board of Trade with a view to the drawing up of regulations. An interesting discussion took place, in the course of which the advantages of electricity for the purpose in view were insisted on by many speakers. It was generally thought, at any rate at first, that some form of government or parochial pecuniary assistance would be required.

The Future of the Storage Battery.

At a dinner given at the "Waldorf" and attended by gentlemen interested in the development of electricity, Mr. Frank W. Hawley, well known for his pioneer work in the application of electricity to the propulsion of canal boats, in responding to a toast "Storage Batteries," dwelt upon the great field for the perfected storage battery.

One of the most perplexing problems connected with electrical development, he said, has been the invention of a perfect storage battery. Much thought and labor have been expended on the subject by chemists and electrical experts, but the results have not been what could be wished. Great improvements, however, have been made, and we can reasonably hope that the near future will produce a battery that will meet all the requirements of science and of commerce, which hope is strengthened by recent statements of Prof. Ostwald, the great German authority on electro-chemistry, and others. As soon as a good storage battery is put upon the market, we shall see the steam locomotive discarded and electricity become the great motive power. Such batteries would be suitable for canal propulsion, and would meet with ready adoption on the street car lines of our cities.

Mr. Hawley referred to the growing use of storage batteries in connection with electric light and power plants. These must otherwise have a generating apparatus sufficient to supply the maximum demand; a demand which continues but a small part of the day. For the balance of time the plant must be operated at a fraction of its capacity and consequently at a loss. But these batteries enable a smaller plant to run on full time, and meet all the demands made upon it at any period of the day. They also enable it to store by day a sufficient quantity for each night's requirements.

Attention was called to the utility of storage batteries as safeguards against any failure of electric supply. They will be a wise precaution when electricity comes into general use for domestic and power purposes. They might also be employed wherever currents are received by overhead wires, since such exposed lines are always liable to be damaged by the elements. Mr. Hawley does not, however, consider them absolutely necessary, but only as a possible convenience. It is not likely they would be required where electricity is conducted over cables enclosed in an underground subway. It is difficult to imagine the possibility of such wires failing to properly transmit currents, particularly in the light of past experience in electrical distribution.

In no way, he stated, is the superiority of the present age more manifest than in its ability to control the powers of nature and vend them in the market place. Oil has long been sent to the great cities by means of pipe lines, and to remote districts in tank cars. Electricity will be similarly distributed. It will be flashed over leagues of space on cables following the highways of commerce, and storage battery cars having an enormous capacity will be constructed and charged either at generating stations in the coal districts, or at stations where the current is generated by water power. These could be sent to their destination just as oil cars now are, and their contents delivered to local distributing stations, or directly to lighting and power mains.

Mr. Hawley directed attention to the fact that in nearly every State in the Union there are great deposits of coal so poor that it would not pay to mine and transport by land or water. But if a generating station should be located at those mines, the poor coal could be transformed into electric energy, stored in such cars as referred to, and shipped to sections where a direct current could not be sent. In the lumber districts of Michigan, also, it would be entirely practicable to erect portable generating stations, where refuse timber could be worked up, affording power to operate mills or for any other need, and the surplus could be similarly transported elsewhere for light, heat and power purposes.

These, he concluded, are some of the numerous uses that could be made of the perfected storage batteries. When once in successful operation, countless other uses will be found for them. Electricity has shown itself capable of infinite service, and its field is daily widening. It can bear thought on its rhythmic wings around the globe; carry the human voice hundreds of miles; deliver messages on board moving trains; flash into dazzling splendors along city thoroughfares; light the abyss of the ocean; operate countless automatic devices; warm us when cold; fan us when heated, and treasure up and repeat all sounds and harmonies. At the summons of inventive genius it has outwrought the dreams of magic. It would, therefore, be idle to say that the end is yet.

Notes on Economy Tests of Electric Railway Plants.

BY GEO. H. DAVIS.

Assuming that a complete test is to be made, the parts that should receive particular consideration are the boilers, the furnace, the steam piping system, engines, condensers, pumps, water piping system, generators, line work from switchboard to terminus of road, motors and track bonding.

It is not intended in what is said here to mention details for the testing of each part of the system. All these things are explained in a most perfect manner in the reports of the American Society of Mechanical Engineers, in "Engine and Boiler Trials," by Dr. R. H. Thurston, and in "Experimental Engineering," by Professor R. C. Carpenter. In these publications may be found all the blank forms necessary for the taking of data, and the results of the complete test calculations, all equations and formulas, and a thorough description of all instruments and their uses.

A few notes with particular reference to railway plants may be of interest.

The tests of different parts must be made simultaneously in order to locate defects in the system of power generation, conversion and transmission, since the conditions are constantly changing. Two tests, one on a constant load and one on a variable load, are always necessary. The variable load trial proves the efficiency of the parts under actual conditions, and for the particular kind of work they are doing. An engine may be so designed and proportioned as to do perfect work in a flouring mill, and also be a total failure in a railway plant. This, in a less degree, is true of boilers and steam fitting. It is plain also that a variable load test is the only one that is at all valuable to the railway company since they have no interest in the economy of the parts outside of the particular duties assigned to them; however, as a check on the work, a constant load test should always be made, because in it greater accuracy can be maintained.

It is always difficult to take readings on variable loads, and the first consideration should be to take them exactly on the second. Boiler room readings may be taken at intervals of five minutes cards should be taken from the engine at intervals of two and a half minutes, with about two tracings on each card, generator readings being taken at the same time, while motor readings may be taken as frequently as each fifteen seconds.

Definite plans for a test must always be made and strictly adhered to; no details can be overlooked without causing serious inaccuracies in the results obtained. The changes in pipe fittings and all preparations for a test must be carefully studied and a sufficient number of reliable men employed, because, if one man fails to do the work assigned him, the entire results may be wholly without value. One competent man should be assigned to the duty of doing nothing except to see everything and remember all that he sees. His information will be valuable in working up the test.

In the preliminary work engine valves should be carefully adjusted and the interior and exterior of the boilers personally inspected, as the least coating of soot or scale makes a large difference in the evaporation. All piping values must be carefully tested, and if any faults are found the valves should have blanks inserted.

The three most accurate men should be assigned to the duty of weighing water and coal and reading voltage and amperage at the switchboard, because these three items form the foundation for the test.

A set of friction cards should be taken at the beginning and another at the end of the test, the final set forming the basis for friction calculations.

The instruments and appliances needed are at least two pyrometers, a barometer, scales and tanks for weighing water and coal, apparatus for flue gas analysis, case of thermometers and thermometer cups, two or three calorimeters, with taps for steam pipes, draught gage, condensing coils and tanks for the measurement of hot drips, speed indicators, engine indicators and attachments, standard steam and vacuum gages, Weston voltmeters and ammeters, a rheostat or tank of water large enough to consume the maximum current, a portable Wheatstone bridge (or the fall of potential method may be used in measuring resistances since they are usually small), a spring balance and some form of dynamometer and tachometer for car tests. All these instruments must be carefully calibrated and a preliminary run made previous to the first day's test.

The constant load test should be made first, because in this readings would be nearly uniform and taken at much longer intervals, thus giving greater opportunities for accuracy. It will also serve to initiate the men who, perhaps, are not accustomed to reading instruments accurately and quickly.

The object of the whole railway design is to convert the heat energy of coal into mechanical energy at the car trucks, and for this reason, in making an economy test, every possible loss of heat should be traced to its source. Thermometers should be placed everywhere, as a steam plant test is practically a heat test. If power house windows have to be open in the winter to keep the building cool it is certainly profitable to know the source of the loss. Heat losses in a plant of this kind are: (1) Heat discharged from the flue. (2) Heat discharged in condensing water; and (3) Radiation and convection from the entire system.

For example, in a large station there are 1,200 square feet of superficial area in the high pressure piping and reservoirs containing high pressure steam. Aside from this area there are those of the heaters, hot water system, and drip system. The steam pressure usually carried is 125 pounds gage, average temperature of surrounding air about 75 degrees F., difference in temperature between steam and air being about 277 degrees F. In experiments on bare wrought iron pipe conducted at Cornell University, under the direction of Professor R. C. Carpenter, it was found that the loss due to convection per square foot per hour in a four-inch pipe at the given difference of temperature to be 425 B. T. U. The losses due to radiation 340 B. T. U., making a total of 765 B. T. U. This would make a total loss in the entire system of high pressure pipe of 918,000 B. T. U. per hour, equivalent to about 65 pounds of coal, equivalent to about 30-horse power at the switchboard per hour.

With a covering on this system of one inch of magnesia and one inch of hair felt, the losses as shown by calorimeter tests were only ten per cent. of the above, making a difference for annual operating expenses for the high pressure pipe alone of $480.

In the summer season the power house should be as cool as a machine shop. The extra coverings necessary to make it so will save enough fuel to pay many times the interest on their cost. It is a mistake to allow twenty or thirty-horse power of heat at from $20 to $30 per annum to pass out of monitor windows. In fact, monitor windows should not be necessary. Enough heat is wasted in some large plants by radiation and convection losses to pay for an additional inch of hair felt over every square foot of exposed high pressure area.

Therefore, in making an economy test, it should not be neglected to place thermometers outside the building and in the engine and boiler rooms. They should be placed on the outside of pipe coverings, engine cylinder jackets and outside of coverings for boiler drums and fronts, besides in the usual places required in a test.

By knowing the temperatures and the superficial area of pipes we have a check on losses due to radiation indicated by calorimeter tests. Calorimeters, as instruments, tell most accurately the quality of steam passing through them, but this steam may not be of the same average quality as that passing through the main. It entirely depends on the form and position of the top pipe used. A spiral pipe used inside the main, being perforated to correspond with the amount of steam passing each point, should give the best sample of steam. But since its form is very inconvenient in placing, the standard form is practically best.

If a careful calorimeter determination is made at the nozzle of the boilers as to the amount of priming water carried over, then it becomes easy from the measurement of drips to determine the loss due to radiation.

The drips can be measured by drawing the water off at a point under the surface of the condensed water in the separator and passing this mixture of water and steam through a condensing coil. The steam appearing in the drips being re-evaporated water due to the change of pressure from that of the separator to that of the atmosphere.

If the unit to be tested is direct belted, speeds of both engine and generator should be taken if possible with a continuous counter, so that belt slippage can be accurately determined. Tests of both direct connected and direct belted units show that there is a loss in large belts of this class not usually accounted for. It probably results from the great and sudden variation of loads in the generator, the thickness of the belt, and the wave motions which are not found in steady loads. Certainly the loss is much greater than that found in woolen mills and flouring mills.

In the generator tests temperatures should again be taken of armature fields and bearings, and a voltmeter and ammeter used on the field circuit both shunt and series, and at the end of the constant load test a characteristic curve of the generator may be taken.

The water rheostat commonly used, consisting of a large tank with copper plates for positive and negative terminals, is practically best. This should be exceedingly well built since the water in it rises to

a temperature of 212 degrees, and a flimsy structure will surely burst, interrupting if not spoiling the test.

With reference to motor tests, a voltmeter should be placed across the terminals, and another from trolley to trucks, and an ammeter inserted in the main circuit. A tachometer should be attached directly, if possible, to the armature shaft; a straight edge 10 feet in length, with a level inserted, and pivoted at one end, will serve to give the approximate grades. Readings each fifteen seconds of ammeter, voltmeters, tachometer level, with times of each, with street and street crossings noted, and such extra notes as should be frequently taken give us all that is of immediate practical value.

If a test of efficiency of gearing is required, the car may be blocked up and a Prony brake applied, first to a pulley on the car axle and next to a pulley on the armature shaft, voltage and amperage being read with those of the brake; from these readings the losses can be deduced.

In the measurement of resistances, such as joints in feeder wires, contacts between trucks and rails through a sand or dirt coating, sections of track bonding, etc., the fall of potential method, using high resistance Weston voltmeters and ammeters, is the most satisfactory. The same method may be employed in the measurement of total overhead line resistance.

The losses due to sand on rails are great as is plainly shown by placing one terminal of a voltmeter in contact with the car truck and the other on a clean portion of the rail. This drop in potential between truck and rail varies greatly, and is often in dry weather a source of greater loss than poor track bonding. An easy way to determine this fall of potential when the car is running is to attach one terminal of the voltmeter to the trucks and the other to a small wheel with a sharp flange, having a handle sufficiently long so that from the rear of the car this wheel can be held on the rail. The knife edge flange will push aside and penetrate any coating of sand, besides cutting through a coating of dirt which is always found clinging closely to the rail surface. This coating, which is found in filthy streets, does not form so great a resistance as sand, but at the same time is a source of loss, and also very hard to remove from the rails.

From the more or less complete tests which have been made during the past four years, it is quite clearly indicated that the following standards of economy are not too high in the best condensing plants:

Equivalent water evaporated per pound of combustible from and at 212 degrees F.....11.50 to 11.75 pounds.
Loss in high pressure piping system, due to convection, radiation, etc.....1 per cent. to 1.25 per cent.
All heat losses aside from heat discharged from furnace flues and from condensers.....15 per cent. to 2 per cent.
Pounds of combustible per indicated horse power per hour, constant load.....1.5 to 1.75
Total friction of engine, belt and generator, .15 per cent. to 20 per cent.
Electrical resistance of double track return circuit, per mile .02 to .03 ohms.

The complete test should be made on an "average day" in the operation of the road. Complete records of the operations of all cars, their weight, etc., all generators, engines and boilers, aside from those under test, should be kept. This data, with the regular test readings, will furnish all that may be required in giving a most satisfactory knowledge of the equipment and a basis for the recommendations of all changes in operation, which the test should indicate.

Equivalent Sine Curve.

In the discussion of the Philadelphia meeting of the American Institute of Electrical Engineers, printed in the November number of the *Transactions*, Mr. C. P. Steinmetz defined the equivalent sine curve as a true sine wave of current of the same frequency as the fundamental, the same effective intensity as the total distorted wave, and shifted against the equivalent sine wave of electromotive force by such an angle that its power in watts equals that of the distorted wave. The equivalent sine wave is not identical with the fundamental sine wave, except in the case where the sum total of higher harmonics is wattless, because the equivalent sine wave includes the energy of the higher harmonics also, and thus the remainder, or the difference between the distorted wave and equivalent sine wave generally includes a component of the same frequency as the fundamental. Resolving a distorted wave into an equivalent sine wave, and a wattless remainder is not identical with resolving it by Fourier's theorem into a series of sine waves, because the equivalent sine wave is not the fundamental component of the total wave, but a wattless remainder of apparently triple frequency may contain a term of simple frequency. To fix a definition of this equivalent sine wave it is "a sine wave of equal effective intensity and equal power with the true wave." If you take a wave of electromotive force, for instance, and a wave of current, then the higher harmonics may, but need not, be powerless. This is especially the case if you have the current distorted by hysteresis.

Mr. A. E. Kennelly, in the course of some remarks, said that when the current is no longer a sinusoidal wave, if it becomes distorted by the action of iron in the circuit, it is a complicated wave. But the ammeter or dynamometer which is used to measure that distorted current, will show some effective current strength which might be attributable to a pure sinusoidal current. It would show a current strength in amperes which would be represented by a sine curve, so that the real current, whose shape can only be determined by a long series of experiments, has an equivalent representation in the dynamometer such as would be produced by a current of the pure sine shape. But if you do not carry the magnetization too nigh—beyond 10 kilogausses—the amplitude of the pure sine wave, such as the dynamometer would lead you to suppose exists, and the amplitude of the actual distorted wave, are equal.

In our last issue we printed the remarks of Dr. Bedell on the same subject.

Symbols and Abbreviations.

The following is from the London Electrical Review of Nov. 16:

Referring to the letter which we reproduced in our last issue, from the *Electrical World*, we should like to offer some remarks. The writer says that one of the fundamental principles (by the way, we have never yet seen any authoritative enunciation of these so-called principles) of the Congress system is "to use script or oblique letters as symbols for quantities and perpendicular letters for the names of units or their abbreviations." Now, script letters such as those shown both in the *Electrical World* and in this paper are *perpendicular* letters. If it was necessary then to substitute perpendicular letters at all for oblique ones, we cannot see any valid reason whatever for preferring script to block letters. For ease in reading and in writing, the latter are very much to be preferred, though strange to say, M. Hospitalier seems to think otherwise. The greatest practical use which will be made of any system, apart from books, will be by the large army of professors and lecturers, and the time which would be saved to them and their students by the adoption of the easy **M** and **H** instead of the troublesome French script, is a matter of some consideration. One thing is certain, that they would have to learn how to write a new alphabet. Apart from this, the block letters have been and are being used by nearly all the leading writers on magnetism of the present day. Ewing, Fleming, and S. P. Thompson, all use them in their well-known works; and *mirabile dictu*, the secretary of the committee which recommended the use of *script* letters, Prof. Nichols. of Cornell University, in his newly published *Laboratory Manual of Physics and Applied Electricity*, himself uses repeatedly, between pp. 201 and 205, *block* letters to represent magnetic quantities. Regarding the vexed question of *C* or *I* for current strength, we are decidedly of opinion that to use *I* would oblige teachers to explain the French use of the word "intensity," and that this would lead students to form a totally wrong idea of what strength of current actually means. In short, as Prof. Jamieson has tersely put it in his strictures on the Committee's recommendations, this word "intensity" has *no meaning* to English speaking people when used in this sense, and would very likely never be used. Why then prefer the initial letter of "intensity," a word which will never be heard, before that of the word "current," which is in constant use by British, Americans, and foreigners alike? If the American Institute of Electrical Engineers adopt the symbol *I* to represent current, they will prove false to the recommendations of their own Badge Committee, which, in the face of the recommendations of the Congress Committee, adopted as *their* mystic symbol, the well-known formula $c = \frac{E}{R}$. (For illustrations, see the *Electrical World*, December 2, 1893, p. 424). Does this not look somewhat like a tacit vote of censure? It is evident that Prof. Macfarlane agrees with Prof. Jamieson's suggestion about the use of the solidus (/) instead of the colon (:) for *per*. In regard to his other objections, we may take another opportunity of discussing them more in detail.

Extracting Teeth Electrically.

A London dentist extracts teeth by giving the patient such a strong current of electricity, with the tongs in circuit that, in his agony, he forgets all about the tooth The dentist calls this a painless extraction of teeth.

The Sag in Span and Trolley Wires.

BY E. A. MERRILL.

In order to determine the proper height of eye bolts or span wire supports above the track when the height of the trolley wire at its lowest point is specified, it is necessary to know the dip or sag in the trolley wire due to its own weight, and also the sag in the span wire due to the combined weights of span wire, trolley wire for one half of each of the adjoining spans, and hanger; the sum of the two sags plus the distance between the trolley and span wires will be the amount to be added to the specified height.

For the purpose of determining these quantities accurately a series

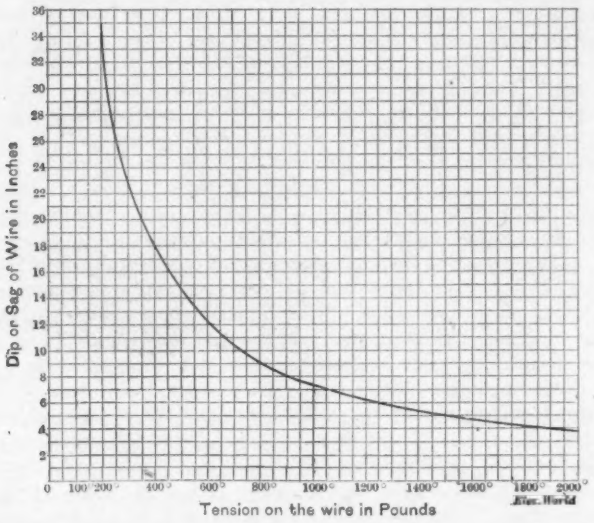


FIG. 3.—DIP OR SAG OF NO. 0, B. & S., TROLLEY WIRE (COPPER) IN A SPAN OF 125 FEET AND WITH VARYING TENSIONS (PLOTTED FROM ACTUAL TESTS).

of carefully conducted tests was made for the Pierce & Miller Engineering Co., by their superintendent, Mr. H. R. Conklin.

Believing that the results of these tests will be of considerable interest and value to many engaged in engineering or construction work they are given below in Figs. 1, 2, and 3.

Fig. 1 represents the usual conditions occurring in single track work, viz., a hanger suspended from the span wire at approximately its middle point, and supporting 125 feet of No. 0 B & S copper trolley wire; the entire weight of the suspension being about 42 lbs. In the test the span wire used was seven strand galvanized signal strand $\frac{5}{16}''$ in diameter, and a weight of 42 lbs. was suspended midway between the supports to represent the combined weight of trolley wire and hanger. The spans were varied from 30′ to 120′, and the strains from 250 lbs. to 3,500 lbs.

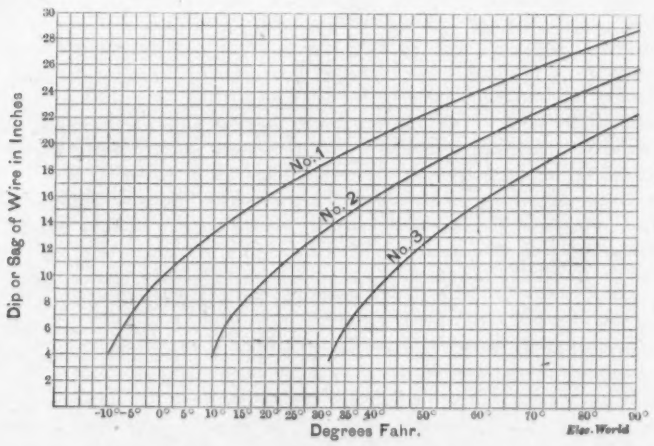


FIG. 4.—DIP OR SAG OF NO. 0, B. & S., TROLLEY WIRE (COPPER) IN A SPAN OF 125 FEET, AND WITH VARYING TEMPERATURES.

If we have the length of the span and know the maximum strain desired on the poles, we are given in these curves the sag in the span at its lowest point. For example suppose we wish to know the sag in a 60-foot span with a strain of 1,000 lbs. on the side poles. Starting at the 1,000 lbs. strain line we follow up to its intersection with the 60-foot span curve and then to the left where we find the sag to be 9 inches.

In the same manner we can find any one of the three quantities if two are known or can be assumed.

Fig. 2 gives similar data for double track work. In this case two weights, weighing 42 lbs each, were suspended 10′ apart and equi-distant from the side supports; the spans and strains being varied as in Fig. 1.

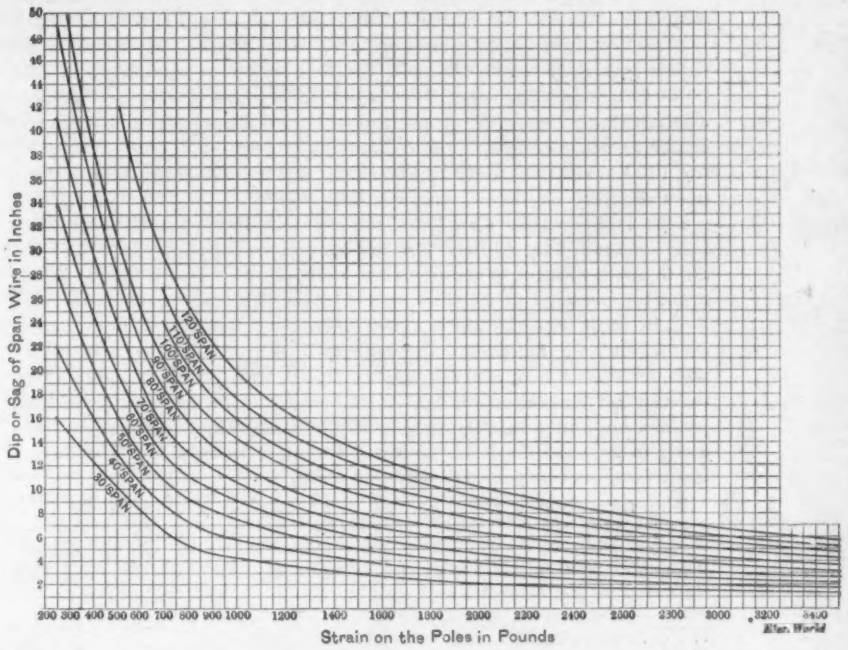


FIG. 1.—DIP OR SAG IN SPAN WIRES, SINGLE TRACK (PLOTTED FROM ACTUAL TESTS).

The curves are probably as accurate as it is possible to make them, as the readings were made with a surveyor's level; for all practical purposes, however, the empirical formulas given below are sufficiently accurate, the error being entirely negligible, at least over the limits of the curves

Fig. 3 gives the sag in a span of 125 feet of the standard No. 0 B & S hard-drawn copper trolley wire under tensions varying from 200 to 2,000 lbs. The tests were carried no further than 2,000

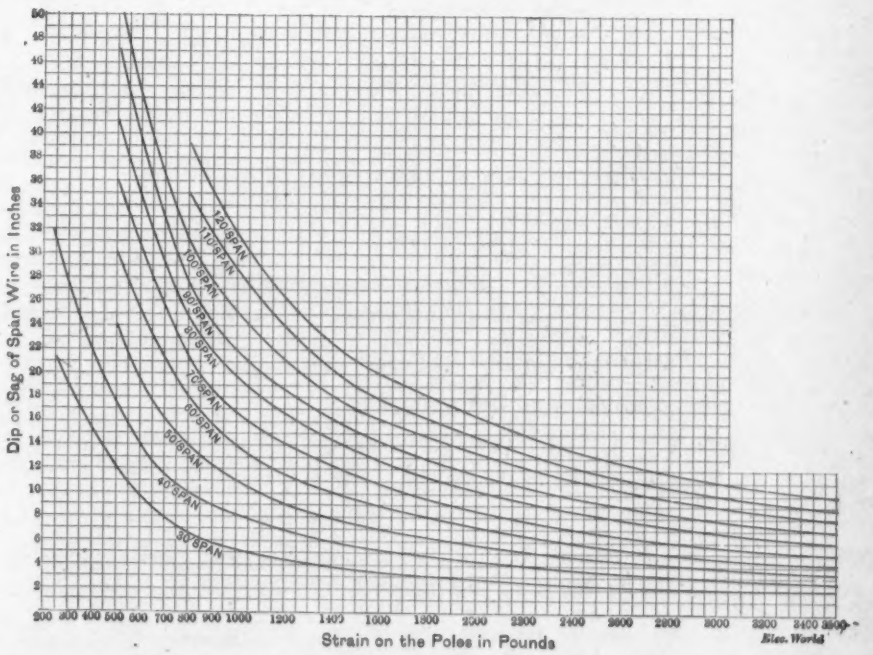


FIG. 2.—DIP OR SAG IN SPAN WIRES, DOUBLE TRACK (PLOTTED FROM ACTUAL TESTS).

lbs. as it is believed that this is the maximum safe working limit, the elastic limit of a line employing soldered clips probably not exceeding on an average 2,000 lbs., and the ultimate tensile strength probably not exceeding 2,800 lbs. If it is desired to carry the limits further the formulas given below for Figs. 3 and 4 can be used; for

it is found that the catenary curve $D = \frac{3 w l^2}{2 T}$, in which w is the weight of the wire per foot of length, and the curve plotted from tests do not materially differ.

To find the total sag it is only necessary to add the span and trolley wire sags as taken from the curves or forumlas, and to this to add the distance between the trolley and span wires, which will vary from 2 to 5 inches with different types of hangers.

There is yet one important element to be taken into consideration which the tests do not include—the variation in sag, and consequently strain, due to varying temperature. In the case of span wires this is generally unimportant as there is sufficient elasticity in the poles to compensate for it; but in the trolley line we have very little elasticity and the result of pulling up a line too taut in summer is either to necessitate splicing a break after every cold snap, or pulling the curves back over the track in the spring if the line has not been securely anchored, perhaps both.

Fig. 4 gives this data in three curves. No. 1 shows the variation in sag assuming that the lowest temperature will be −10° F., No 2. for a minimum temperature of 10° F. and No. 3 for a minimum temperature of 32° F. In each case the tension on the wire at the lowest temperature is 2,000 lbs. For example, if the sag at 10° F. is 3.73 inches and the tension 2,000 lbs., the sag at 80° F. will be 24.1 inches, and by reference to Fig. 3 it will be seen that the tension has fallen to 290 lbs. Therefore, if the trolley wire is put up when at a temperature of 80° F. it should be allowed to have a sag of 24.1 inches at its middle point if it is expected that during the winter its temperature will fall to 10° F.

The formula for these curves is $D = \sqrt{8.1\ t + 14}$ in which D is the dip or sag in inches, and T is the number of degrees F. by which the actual temperature exceeds the temperature at which the tension is assumed to be 2,000 lbs. For example we will assume the minimum temperature to be 10° F. and the actual 80° F., the difference is 70 and the formula becomes

$$D\ l = \sqrt{(8.1 \times 70) + 14} = \sqrt{567 + 14} = \sqrt{581} = 24.1 \text{ inches.}$$

Since the tension varies inversely as the dip, the above formula can be used for any maximum tension by proper substitution. For example, if we assume the maximum tension to be 1,500 lbs. the value of D will be $\frac{2}{1.5}$ times the value given by the above formula for any temperature, and the forumla becomes

$$D = \frac{2}{1.5}\sqrt{8.1\ T + 14} = \sqrt{14.4\ t + 25}$$

Resumé of formulas:

D = dip in inches;
l = length of span in feet;
S = strain on poles in pounds, from 250 to 3,500 lbs.
t = number of degrees between actual temperature F. and the temperature at which the tension is 2,000 lbs.
T = tension in pounds.

Dip or sag in span wire—

SINGLE TRACK (FIG. 1).

$$D = \frac{l}{S}\left(120 + \frac{l}{2}\right) \text{ (Empirical).}$$

DOUBLE TRACK (FIG. 2).

$$\left.\begin{aligned} D &= \frac{l}{S}(160 + l) \text{ up to 100 feet} \\ D &= \frac{l}{S}(150 + l) \text{ from 110 to 130 feet} \end{aligned}\right\} \text{(Empirical).}$$

Tension on trolley wire (Fig. 3):

$$T = \frac{7{,}477}{D}$$

Dip or sag in trolley wire (Fig. 4):

$$D = \sqrt{8.1\ t + 14}$$

The formula for Fig. 3 is derived from the catenary formula given above by substituting the value of w and l.

High Candle Power Gas Rivalry.

BY H. W. FRUND.

Among the topics coming to the attention of the general manager is the periodical appearance of the Auer (Welsbach) gas burner. This burner, which has appeared and as quickly disappeared from the public during the past eight years, is now again being actively pushed and introduced, especially in towns and cities where gas and electric competition is fierce. It may not be amiss to state that this burner is not new as represented, and that its history dates back to 1880, when Carl Auer, then a pupil of Prof. Bunsen at the University of Heidelberg, became interested in the subject of illumination and soon thereafter invented the burner, which at best is not pretty, and emits a ghastly gleam suggestive of the whited sepulchre. It is also the same old gas, the light remains naked and the results of combustion remain just as deleterious and more poisonous than ever. The Journal of the Franklin Institute, English and French contemporaries, comment unfavorably upon this burner. Herr. v. Obechelhauser, in his lecture on the gas industry in the United States, at Karlsruhe last June stated "The old burners of both Fahnehjehn and Auer proved failures in America."

The first trial of consequence of the Auer burner has been during the past two years in the gas belts of Indiana and Ohio, where the burner has proven a dismal failure with natural gas. The results with manufactured gas last winter are claimed to have been better—strange to say, however, only in cities where electric companies run at all hours, the competing gas company struggling as it were to hold what few customers it might have.

Prominent gas engineers claim that while the lighting power of gas has had to be increased, the Welsbach burner in legitimate competition with electricity is a failure and would prove the greatest bane to gas companies. Where competition has been greatest, managers from their experience and observation on this point say: "This new burner when it was first introduced created quite a furore, and caused some little anxiety among our stockholders. After being in use about one year we find it is losing its popularity, as experience has demonstrated that it deteriorates faster than the incandescent light. After burning about 100 hours it does not give as much light as a 16-cp. incandescent. It is also a great consumer of oxygen and gives more heat than the ordinary burner. It is very frail and delicate to handle, the sulphur from a match oftentimes breaking the thin gauge. We find them overrated to the extreme, using about 9 ft. of gas per hour when new, and giving about 42 cp. After using 4 weeks the same burner and with the same gas pressure we got only 15 cp. with a consumption of 11 ft. of gas. You will have to look out for all kinds of trickery. For instance your competitor will go to your customer, and after finding out their contract rate for electric light will guarantee them a saving of 40 per cent. if they will put in the Welsbach burner, and also put them in on 30, 60 or 90 days trial. In the meantime they will underrate the gas meter until they have apparently demonstrated to your customer a saving of 40 per cent.; the customer then pays his $2 each for the burners and is happy. In the course of a month or two lights begin to go down, the gas bill goes up, and then comes the clash, and the customer gets the worst of it."

Another says "I am firmly of the opinion that the burner and the effort to establish it will be of short duration, and that its temporary adoption was due mostly to business depression and an effort to curtail expense. Mr. Butterworth, president of the Ohio Gas Association, in March said the gas companies had quite a falling off in gross receipts due to bright weather, depression in business and electric light."

Another says, "We own the electric and gas works. We have tried the Welsbach burner but do not find our customers anxious to continue its use. The people desire simplicity and will not bother with the Welsbach. We have six or seven burners in use, all others having been ordered out by users."

Another says, "There are some Welsbach burners in use here, less now than four years ago. There were about twelve here four years ago and the people discarded most all of them."

It appears that this burner is used mostly by gas companies in their struggle to keep above water, as it were. They enter into a combat that will probably end in mutual disaster, hoping, thereby to enter into a combination that shall jointly serve the twin interest. In such instances it would seem politic for electric companies, where they have no desire to combine, not to consider the competition of such burners as permanent, and the best plan of meeting it satisfactorily is to discard incandescent lighting by low efficiency lamps and in lieu use lamps of high efficiency and, best of all, the subdivided arc ranging in candle power from 700 to 1,000 candle power, which is being succesfully used in alternating current systems. In the larger cities such as Boston, Pittsburgh and Baltimore, the 900-cp. lamp has wiped out the high candle power gas burners.

The Best Way of Saying It.

Our contemporary, the London *Electrician*, makes the suggestion that "technical journals when they have nothing to say might be well excused if they refrain from saying it."

Resonance.

Mr. C. P. Steinmetz, in the discussion on the paper of Dr. Pupin, read before the Philadelphia meeting of the American Institute of Electrical Engineers, and printed in the November number of the *Transactions*, claimed that resonance was merely a special case of a well known phenomenon. He recalled the fact that if in an alternating circuit a self-induction is inserted, the self-induction will consume an E. M. F. lagging behind the impressed E. M. F. by 90 degrees, or a quarter period. The resistance will consume an E. M. F. in oppositon to the impressed E. M. F.; and a condenser in serted in the circuit will take a current leading 90 degrees.

Next is considered what takes place if there is a circuit closed by a condenser, that is a circuit whose current leads the E. M. F. by 90 degrees or a quarter period, and having in series with the condenser a self-inductance. By self-induction a counter E. M. F. is induced which lags 90 degrees behind the current. But the current is 90 degrees ahead of the impressed E. M. F. Thus, the counter E. M. F. of self-induction is in phase with the impressed E. M. F. and adds itself thereto. Hence, the effective E. M. F. is increased by the self-induction being brought into phase with the impressed E. M. F., and if this increase is excessive, it is called "resonance," but it is nothing different from the action of the choking coil, which produces a counter E. M. F., 90 degrees behind the current, and thereby, according to the phase relation between current and impressed E. M. F., either reduces the E. M. F. if the current is lagging, or increases the E. M. F. if the current is leading.

Thus, if suppose we have a condenser with an impressed E. M. F. of say 100 volts, and taking 10 amperes with a self induction in series which with 10 amperes current will produce a counter E. M. F. of 100 volts; this counter E. M. F. of 100 volts is now due to the lead of the current, in phase with the impressed 100 volts, adds itself thereto and thus gives 200 volts t the condenser terminals, with 100 volts impressed at the generator. These 200 volts will double the current and you get 20 amperes through. These 20 amperes will induce a counter E. M. F. of self induction of 200 volts. Then you get 400 volts at the condenser terminals. That means 40 amperes and 400 volts at the self-induction. So it is seen that the self induction in series will raise the condenser E. M. F. infinitely, that is, until the increase of the current causes the resistance to consume the total impressed E. M. F. It is therefore claimed by Mr. Steinmetz that resonance is nothing but our well known old friend self induction introducing an E. M. F. lagging 90 degrees behind the current and thereby affecting the impressed E. M. F. according to the phase relation of the current.

Hysteresis.

In the discussion on the papers of Dr. Pupin and Mr. C. P. Steinmetz, read before the Philadelphia meeting of the American Institute of Electrical Engineers, and printed in the November number of the *Transactious*, Mr. Steinmetz refers to the misconceptions in regard to the definition of hysteresis. He states that molecular magnetic friction is *not* identical with hysteresis, and defines magnetic hysteresis as the disproportionality between the magneto-motive force and magnetism, as the name signifies, which disproportionality is produced if upon an alternating magnetic circuit no energy is expended; since energy is consumed in the circuit by the molecular magnetic friction, this energy must be supplied from somewhere, and, in the absence of any other source of energy, is supplied by the magnetomotive force in the form of magnetic hysteresis. But this energy may be supplied by mechanical energy, and this is the case in smooth core machines, and then we may not find any hysteresis, or any disproportionality between magnetic field strength and magnetomotive force.

In a transformer the iron core is indeed set in vibration by the alternating magnetism, but this vibration, Mr. Steinmetz states, cannot supply the energy consumed by molecular friction and thus cannot eliminate magnetomotive force, and has the effect of intensifying the loss of energy—increasing the area of the hysteretic loop by the loss of energy in mechanical vibration, thus intensifying the higher harmonics, since now energy is expended not only by molecular magnetic friction, but also by mechanical vibration.

In another place Mr. Steinmetz states in regard to the loss of energy by magnetic friction in a rotary magnetic field, as for instance in the revolving armature of a bipolar smooth core dynamo, that he found no essential difference than with the loss in an alternating field, but that occasionally the observed core loss in the armature of a machine is not the molecular magnetic friction only, but superimposed upon it are eddy current losses in the iron, the shields, etc., and in the conductors, which losses are proportional to the square of the magnetization. Thus, the observed core loss sometimes rises with a power higher than 1.6, sometimes nearly approaching the square. But by laminating the iron very carefully, designing the mechanical construction so as to expose no solid metal to the alternating field, and shaping the conductors so as to exclude eddy currents, he always got curves very nearly proportional to the 1.6 power, up to very high magnetic densities (about $\mathfrak{B} = 19{,}000$). He thinks the law holds for generators just the same, and therefore believes the law applies, not to the hysteresis loss, but to the loss by molecular magnetic friction, since in the generators we probably have no hysteresis. Mr. Steinmetz states he took pains once to find out if there is a lag of the magnetism behind the resultant megnetizing force in a generator which would distort the wave of electromotive force, but did not find anything of the kind. Thus the total loss of energy, which may be many kilowatts, may be supplied directly by the mechanical power, in which way he was not able to say, but not in the form of a hysteretic loop, at least not a hysteretic loop of noticeable size.

In reply to Dr. Pupin Mr. Steinmetz stated that hysteresis has a well defined meaning. It was introduced merely to denote the lag of the magnetism behind the magnetomotive force, as the derivation of the word signifies, which lag causes the magnetism as a function of an alternating M. M. F. to describe a closed curve, the "loop of hysteresis." Afterward it was shown by Warburg and Ewing that the area of the hysteretic loop represents energy, and represents the energy expended by the magnetomotive force during the cycle of magnetism, and from this the erroneous conclusion has been drawn that this hysteretic energy is the energy lost in the iron by molecular magnetic friction, that is, by changing the mangetic state of the iron. Mr. Steinmetz asserts that this conclusion is wrong; that this energy expended by the magnetomotive force is not necessarily the energy wasted in the iron. The energy represented by the hysteretic loop or a part of it may be converted into mechanical motion, or the energy lost in molecular magnetic friction may be supplied by mechanical energy, and the hysteretic loop may collapse, or may expand considerably, so that between the area of the hysteretic loop and the loss of energy in the iron there is no direct relation.

Sine Form of Curves of Alternating E. M. F.*

BY C. F. SCOTT.

Seven years ago I was engaged in the testing of some motors, the first motors of the Tesla type, by the way, which were used for commercial work. I had gone over the designs and had tested some preliminary experimental motors and thought I had everything covered with regard to the construction of the motors. A number had been made and in the test of the first one the motor had been carrying its load for an hour or more when I found an unduly high temperature. I found the speed had fallen from synchronism fully fifty per cent. more than it should have fallen, and the motor, instead of coming up to a definite temperature, kept going up on what was a rather straight line. I had a second generator started and transferred the motor from the generator that had been running to the new one. The speed immediately came to what it should be and the temperature began to fall, although the load was the same. The heating of the motor with one generator was equivalent to what would have been obtained by carrying half or two-thirds additional load with the second generator. The second generator, the good one, gave a curve which was approximately a sine-curve. The first generator gave a wave form which was measured and found to be very much depressed at the middle, where the sine-curve is maximum, showing that the third harmonic was very strongly present.

An analysis of the effect of the third harmonic in the rotating field shows some rather interesting relations. The third harmonic evidently tends to a synchronous speed which is three times as great as the fundamental, so that if we have present a third harmonic we are tending of course to two speeds of rotation, the speed of the fundamental and another three times as fast. This third harmonic, however, is negative in its tendency to rotation. That is,

*From discussion on Dr. Duncan's paper on "Experiments with Two-Phase Motors," printed in November number of *Transactions* of the American Institute of Electrical Engineers.

the fundamental produces rotation in one direction and the third harmonic not only tends to produce a different speed, but it is in the opposite direction. This can be very simply shown by drawing a sine-wave and its third harmonic, and also a second wave which is a quarter-phase from the first, together with its harmonic. You will notice that if the first fundamental comes before the second one, that the third harmonic of the first comes after that of the second one. Consequently the fundamentals tend to rotation one way, and the third harmonics in the opposite direction. By different relative values of the two we may get almost anything. We may get normal rotation or no rotation at all, or rotation at normal speed in the opposite direction, or twice normal speed or three times normal speed.

Practical Notes on Dynamo Calculation—XIX.

BY ALFRED E. WIENER.

(*b*) *Bore of Pole-Pieces.*

The diameter of the pole pieces, or the bore of the field, d_p, i given by the diameter of the armature core, the height of the armature-winding, and the clearance between the armature-winding and the pole-pieces:

$$d_p = d_a + 2 \times (h_a + k_{12}); \quad \ldots\ldots\ldots\ldots (104)$$

d_a = diameter of armature core, in inches;
h_a = Height of winding-space, including insulations and binding-wires, in inches;
k_{12} = Clearance between external surface of finished armature and polepieces, in inches. See Table XLVIII.

The latter dimension, which is to be taken as small as possible, in order to keep the air-gap reluctance at a minimum, ranges between 1-32 and 7-16 inch, according to the kind of the armature and its size. The following Table XLVIII, may serve as a guide in fixing its limits for any particular case:

TABLE XLVIII.—RADIAL CLEARANCE FOR VARIOUS KINDS AND SIZES OF ARMATURES.

Diameter of Armature, in Inches.	Radial Clearance, k_{12}, in Inches.					
	Smooth Armature.					Toothed and Perforated Armature.
	Disc or Ribbon Core.			Wire Core.		
	Wire Wound.		Copper Bars.	Wire Wound.	Copper Bars.	
	Drum.	Ring.				
Up to 2	1/32	..	..	1/32	..	1/32
" 4	1/32	1/32	..	1/16	..	1/32
" 8	1/32	1/32	..	1/16	..	1/32
" 12	1/16	1/32	1/32	1/16	1/32	1/32
" 18	1/16	1/16	1/32	1/16	1/32	1/32
" 24	1/32	1/16	1/16	1/16	1/16	1/32
" 30	1/16	1/32	1/16	1/32	1/32	1/32
" 40	..	1/16	1/32	1/16	1/16	1/16
" 50	..	1/32	1/16	1/32	1/32	1/32
" 75	..	1/16	1/32	1/16	1/16	1/32
" 100	..	1/32	1/16	1/16	1/16	1/32
" 125	..	1/16	1/32	..	..	1/16
" 150	..	1/32	1/16	..	..	1/32
" 200	..	1/16	1/16	..	..	1/16

The above table shows that with toothed and perforated armatures the smallest clearance can be used, a fact which is explained by the consideration that the exteriors of these armatures offer a solid body, and may be turned off true to the field-bore. From a similar reason wire-core armatures need a larger clearance than disc-core armatures, since the former cannot be tooled in the lathe, and have to be used in the more or less oval form in which they come from the press. Since copper-bars can be put upon the body with greater precision than wires, a somewhat larger clearance is to be allowed in the latter case. Finally, a drum armature, in general, has a higher winding space than a ring-armature of same size, the unevenness in winding will, consequently, be more prominent in the former case, and therefore a drum armature should be provided with a somewhat larger clearance than a ring of equal diameter.

The figures given in Table XLVIII may be considered as average values, and, in specially favorable cases, may be reduced, while under certain unfavorable conditions an increase of the clearance may be advisable.

(*c*)—*Polar Embrace.*

The dimensions of the magnetic field having thus been determined, half the pole-space angle, α, Fig. 47, can be found from the trigonometrical equation:

$$\sin \alpha = \frac{e_p}{d_p}; \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (105)$$

e_p = pole-distance, in inches, from formula (103);
d_p = diameter of polepieces, in inches, from formula (104);

The ratio of polar embrace, or the percentage of polar arc, then, is:

$$\beta = \frac{90^\circ - \alpha \times P}{90^\circ}, \quad \ldots\ldots\ldots\ldots\ldots (106)$$

in which α = half polespace angle, from (105);
P = Number of pairs of magnet poles.

From (106) follows, by transposition:

$$\alpha = \frac{90 \times (1 - \beta)}{P}, \quad \ldots\ldots\ldots\ldots\ldots (107)$$

from which the pole-space angle, α, can be calculated in the case that the ratio of embrace, β, of the pole-pieces is given.

35.—Relative Efficiency of Magnetic Field.

The useful flux of the dynamo being found from formula (91), the number of lines of force per watt of output, at unit conductor-velocity, will be a measure for the magnetic qualities of the machine, and may be regarded as the *relative efficiency of the magnetic field.*

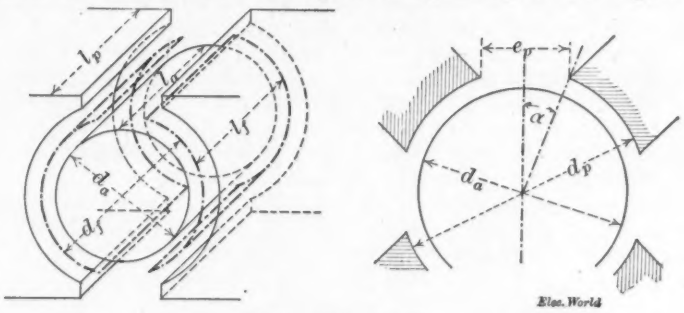
The field-efficiency for any dynamo can accordingly be obtained from the equation:

$$\zeta = \frac{\Phi}{E \times C} \times S = \frac{\Phi}{W} \times S, \quad \ldots\ldots\ldots\ldots (108)$$

where

ζ = Relative efficiency of magnetic field, in webers per watt of output at a conductor-velocity of 1 foot per second.
Φ = Useful flux of dynamo; from formula (91) or (92).
E = Total E. M. F. to be generated in machine, in volts.
C = Total current to be generated in machine, in amps.
$W = E \times C$ = Total output of machine in watts;
S = Conductor-velocity, in feet per second.

The numerical value of this constant, ζ, varies between 4,000 and 40,000 lines of force per watt at 1 foot per second, according to the size of the machine, the lower figure corresponding to the highest



FIGS. 46 AND 47.

field-efficiency; and for outputs from ¼ kw to 2,000 kw, for bipolar and for multipolar fields, respectively, ranges as per the following Table XLIX, which is averaged from a great number of modern dynamos of all types of field magnets.

TABLE XLIX.—FIELD EFFICIENCY FOR VARIOUS SIZES OF DYNAMOS.

Capacity, in Kilowatts.	Value of ζ, in Webers per Watt, at Unit Conductor Velocity.	
	Bipolar Fields.	Multipolar Fields.
Up to .25	15,000 to 40,000	.....
.25 to 1	10,000 to 20,000	.....
1 to 10	8,000 to 15,000	10,000 to 20 000
10 to 50	7,000 to 12,000	8,000 to 15,000
50 to 100	6,000 to 10,000	7,000 to 12,000
100 to 500	5,000 to 7,500	6,000 to 10,000
500 to 1,000	.....	5,000 to 7,500
1,000 to 2,000	.....	4,000 to 6,000

For a newly designed machine, the value ζ obtained by means of formula (108) will be within the limits given in this table, provided the armature has been calculated in accordance with the rules and tables furnished in the respective chapters of Part I.

As from Table XLIX follows the self-evident fact that the magnetic fields of large dynamos are more efficient than those of small ones, a curve was plotted in order to examine the rate of this increase. For this purpose the useful fluxes of all the dynamos considered were reduced to the basis of a conductor velocity of 50 feet per second, when the heavy curve, Fig. 48, was obtained by averaging the values of the flux thus found:

From this curve a law can be deduced for the increase of the field-efficiency with increasing size. In the following Table L, from the average useful flux for 50 feet conductor velocity, as plotted in Fig. 48, the specific flux per kilowatt has been calculated, showing the rate of increase of the field-efficiency:

TABLE L.—VARIATION OF FIELD-EFFICIENCY WITH OUTPUT OF DYNAMO.

Capacity, in Kilowatts.	Total Average Useful Flux, at Velocity of 50 feet per Second.	Specific Flux, Webers per Kilowatt, at 50 feet per Second.
.1	100,000	1,000,000
.25	200,000	800,000
.5	350,000	700,000
1	600,000	600,000
2.5	1,300,000	520,000
5	2,300,000	460,000
10	4,000,000	400,000
25	8,500,000	340,000
50	15,500,000	310,000
75	22,000,000	294,000
100	28,000,000	280,000
200	50,000,000	250,000
300	70,000,000	233,000
400	88,000,000	220,000
500	104,000,000	208,000
600	118,000,000	197,000
700	130,000,000	186,000
800	141,000,000	176,000
900	151,000,000	168,000
1,000	160,000,000	160,000
1,200	175,000,000	146,000
1,500	195,000,000	130,000
2,000	220,000,000	110,000

By the law of inverse proportionality between useful flux and conductor-velocity, the remaining curves for 25, 30, 40, 60, 75 and 100 feet per second, respectively, were then drawn in Fig. 48.

Tabulating all the values thus received we obtain the following

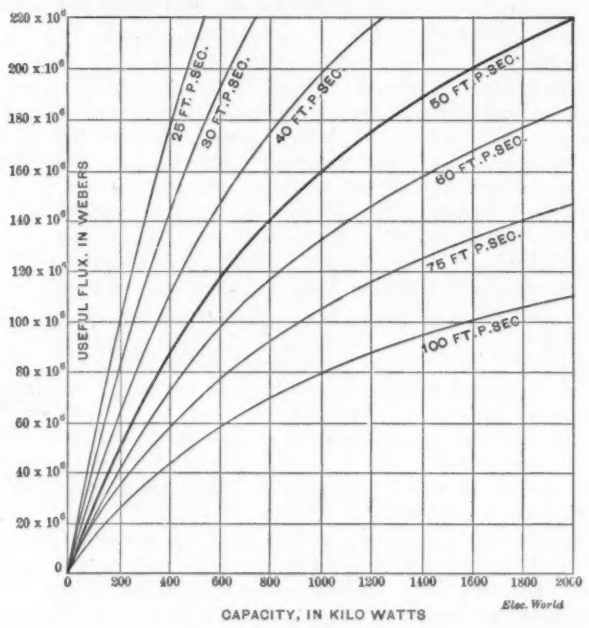


FIG. 48.

Table LI, giving average values of the useful flux for various conductor-velocities:

TABLE LI.—USEFUL FLUX FOR VARIOUS SIZES OF DYNAMOS AT DIFFERENT CONDUCTOR-VELOCITIES.

Capacity in Kilowatts.	Average Useful Flux, in Webers, at Conductor-Velocity, per Second, of						
	25 feet.	30 feet.	40 feet.	50 feet.	60 feet.	75 feet.	100 feet.
.1	200,000	167,000	125,000	100,000	83,000	....	....
.25	400,000	333,000	250,000	200,000	167,000	....	....
.5	700,000	583,000	438,000	350,000	292,000	....	....
1	1,200,000	1,000,000	750,000	600,000	500,000	400,000	....
2.5	2,600,000	2,200,000	1,600,000	1,300,000	1,100,000	870,000	....
5	4,600,000	3,800,000	2,900,000	2,300,000	1,900,000	1,500,000	....
10	8,000,000	6,700,000	5,000,000	4,000,000	3,300,000	2,700,000	....
25	17,000,000	14,200,000	10,600,000	8,500,000	7,100,000	5,700,000	....
50	31,000,000	25,800,000	19,400,000	15,500,000	12,900,000	10,300,000	....
75	44,000,000	36,700,000	27,500,000	22,000,000	18,300,000	14,700,000	11,000,000
100	56,000,000	46,700,000	35,000,000	28,000,000	23,300,000	18,700,000	14,000,000
200	100,000,000	83,300,000	62,500,000	50,000,000	41,700,000	33,300,000	25,000,000
300	140,000,000	117,000,000	87,500,000	70,000,000	58,300,000	46,700,000	35,000,000
400	....	147,000,000	110,000,000	88,000,000	73,300,000	58,700,000	44,000,000
500	....	173,000,000	130,000,000	104,000,000	86,700,000	68,300,000	52,000,000
600	....	197,000,000	148,000,000	118,000,000	98,300,000	78,700,000	59,000,000
700	....	216,000,000	163,000,000	130,000,000	108,000,000	86,700,000	65,000,000
800	....	235,000,000	176,000,000	141,000,000	117,000,000	94,000,000	70,500,000
900	....	....	189,000,000	151,000,000	126,000,000	101,000,000	75,500,000
1,000	....	....	200,000,000	160,000,000	133,000,000	107,000,000	80,000,000
1,200	....	....	219,000,000	175,000,000	146,000,000	117,000,000	87,500,000
1,500	....	....	244,000,000	195,000,000	163,000,000	130,000,000	97,500,000
2,000	....	....	275,000,000	220,000,000	183,000,000	147,000,000	110,000,000

(To be continued).

Notes on the Management of Railway Power Stations—VIII.

BY GEORGE T. HANCHETT.

The Car Equipment (Mechanical).

The mechanical design of the average street car truck is one of the few things in motive street railway construction that has taken a step backward. There are very few of the street car trucks now offered to the street railway officials that are properly designed. The designer of the crudest wagons first fastened an axle securely to the flooring. That was found to hammer and jolt considerably even on the smoothest road. Then came the spring seat. This added to the comfort of the person riding in the wagon, but had no mercy on the other load of the wagon or the road over which it was travelling. The need of springs on the axles was felt and supplied, and lastly, wherever feasible, the pneumatic tire has been adopted, where ease of riding is the main object. The vehicle became more and more easy on both road, and wider as the spring suspension approached the point of contact with the earth. Plainly as this lesson has been taught, the truck designers have signally failed to reduce the hammer blow by this simple expedient.

This will perhaps be plainer by an even simpler illustration. If a hammer be constructed, as *A* in Fig. 23, with a thin plate of steel suspended by a spiral spring as shown, it does not require an engineer to see that the driving of a nail, or, in short, striking a

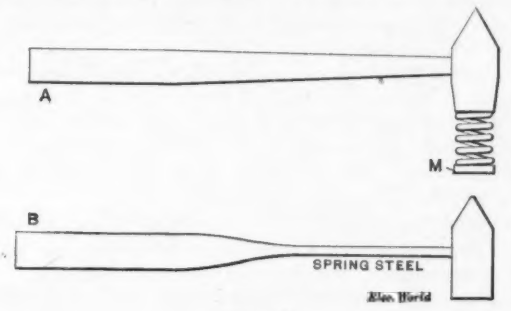


FIG. 23.

heavy blow, would be extremely difficult. In direct proportion as we increase the mass of the piece, *M*, the blow becomes heavier and heavier till at least as the spring recedes from the face of the hammer we approach the hammer, *B*, in which a spring handle is used. With this hammer a tremendous blow can be struck, heavier even than if there were no spring in its construction at all.

This design is what is usually followed in the average street car truck. The first thing the designer does is to fasten rigidly to the axle boxes of the truck a heavy frame on which is mounted the motor, often rigidly also. This forms the heavy hammer head. To provide for the comfort of the passengers the next step is to furnish a powerful spring handle in the shape of a row of elliptic, spiral, or leaf springs between the car body and the truck proper. The car body forms a tireless arm of great power to manipulate the device. A better all-around scheme to ruin tracks could not be designed.

In order to reduce the hammer blow on the joints, place the spring suspension as near the point of contract with the earth as possible. It is practically impossible to excel pneumatic tires on smooth surfaces for ease of riding. A machine with spring spokes, if such were possible, would be next in value in this regard. It is then obvious that the spring suspension of a railway truck should be on the axle box. This is the farthest that present practice can carry out the principle here set forth. The hammer blow was never a problem with steam roads for the simple reason that even the poorest trucks were designed with the springs as near as practicable to the axle-boxes. There is a truck used under a freight car which in its design is vastly superior to the average modern street cab truck, simply because the springs are on the axle-boxes. The difficulty of building a low truck with the springs placed in this manner has largely contributed to the resulting incorrect designs. The station manager usually approves the truck and should look for these points when his opinion is asked.

Light trucks and motors are of evident value and are widely appreciated. This is only another means of approaching the same end. Returning to our hammer illustration we see that this simply diminishes the mass of the piece "A."

If we look over the usual instructions for the installation of an electric motor we invariably find "The motor should be located in a cool, dry room, free from dust or flying particles of any sort." Between the wheels of a street-car truck is then as nearly the oppo-

site of this requirement as one can well imagine. Not one of the above conditions is satisfied. In view of this the motor should have exceptionally good care. This can only be given by frequent and careful inspection. The dynamo and engine in the power-house are carefully watched and oiled. They are well located and have every advantage. On the same principle the street car motor needs much more care, due to its unfavorable location.

At the end of every trip it should be run over the pit. Loose nuts, hot boxes, burnt commutator bars, and matters of a kindred nature, should be carefully sought for. Dust or mud should not be allowed to accumulate. Designers have produced motors that are admirable for resisting dust and moisture, but that should be no excuse for allowing the latter to accumulate any more than an efficient safety stop is an excuse for the use of a fly wheel of weak and unreliable material. The screws of the motor support should receive minute inspection. Every screw on the truck is liable to be jarred loose and the dropping of the motor into the street is almost certain to wreck the greater part of the equipment, both mechanically and electrically. Do not be satisfied with simple, rapid inspection. Open the motor box. For an experienced man, with the tools at hand, it is but the work of a moment. It is almost impossible for foreign matter to lodge there with modern enclosed motors, but it is equally impossible for the obstacle to find an exit. The chances are that whatever does succeed in getting in is there to stay, unless it is removed.

Washers, carbon dust, bits of gravel, sand, pieces of carbon brushes, and other matter capable of doing serious damage, have been found in the motor cases of some of the best types. The inspector should thoroughly understand the motor and all its parts. The time for inspection is usually brief, but everything must be noted. Spare parts should be at hand and no armature or field coil in which a defect is suspected to exist should be allowed to go on a trip. In no case is the old adage of a "stitch in time" truer than in the case of the railway motor.

It is not wise to change the motormen about promiscuously. Have each motorman with a regular motor under his charge and hold him responsible. Motormen frequently race their motors to the limit, stop with a jerk and start up again at break-neck speed. When they approach the car barn they are careful to proceed slowly for the double reason of appearing exactly on time with a cool motor. By placing a bit of paste board with paraffine wax at a carefully determined distance from the bearings on the interior of the motor case, the culprit may be detected and deserved reprimand administered. It is obvious that the proper position for this pasteboard is nearer the bearing in winter than in summer.

Above all, a record of every inspection should be made. By this means the cause of an accident can in nine times out of ten be determined, and it is only by a thorough knowledge of causes that we shall be able to control results.

In running the car remember that the motor is hung very near the ground and that it does not require much of a stone to be an obstacle. Run carefully over curves, crossings and switches and thus save both them and the motors. With a little practice the motorman can accustom himself to the ordinary sights, sounds and smells on and about a car equipment and anything unusual will at once be detected.

The one thing that is most liable to derange the mechanical portion of a car equipment is vibration. This is largely met by a properly designed truck, but a careful motorman can also do much to reduce this evil.

The car should be provided with a monkey wrench, a few duplicates of the most important bolts and nuts, a pair of plyers, some rubber tape and a supply of insulated copper wire about No. 8 B. & S. With these simple tools and materials vexatious delays can often be avoided.

The motorman should be present when his motor is taken apart and inspected. By this means he will become familiar with the various parts and their diseases. The motor is under his care the greater part of the time and therefore the more he knows of its construction the fewer accidents there will be. A green motorman is one of the most expensive things a general manager has to contend with. If an increase of pay is held out to the men as the number of accidents that they meet with becomes smaller and those that they do meet with are successfully met, the result will be a crew of men that will save not only the machines but will also save the company from suits for damages to property and life. If the men are given to understand that the increase that they earn by care is subject to forfeiture by subsequent carelessness, this will be an additional incentive.

(To be continued.)

Relation Between Line Wire Losses and the Over-Compounding of Dynamos.

To the Editor of The Electrical World:

Sir: In The Electrical World of October 13th., Prof. E. P. Roberts published an article on the "Relation between Line Wire Losses and the Over-Compounding of Dynamos," in which he points out certain difficulties that may arise when over-compounded generators are run in parallel. He discusses several cases and in regard to case 2, states that "this method is correct in principle" and that case 3, "also is theoretically correct." The rest of the article is entirely devoted to showing how serious the trouble may be. It occurred to me while reading the article that it would be likely to be misunderstood and that the reader might think the difficulty almost insurmountable or only "theoretically" avoidable. This idea has since been borne out by the fact that a prominent magazine has referred to the article in this way. As a matter of fact, the remedy is perfectly simple and entirely effective.

In the little book on "Practical Management of Dynamos and Motors" by Dr. S. S. Wheeler and the writer, the remedy for this trouble is given (1st. Edit. 1892, page 28; 2d. Edit. 1894, page 56). This consists in leaving the "equalizer" permanently connected in all the machines so that the series coils are always in circuit in parallel which "has the effect of compounding the dynamos collectively instead of individually" and "makes the effect of the series coil proportional to the total load instead of the load on each machine." This method is identical with case 3, of Prof. Roberts which he merely states to be "theoretically correct" without explaining it or saying whether it is practically operative and satisfactory.

The only objection to this method is that it requires the series coil of every dynamo to be in circuit whether the machine is working or not, and in the cases of high tension machines it would be particularly undesirable to have them "alive" (*i. e.* connected to the circuit) while they were being cleaned. This difficulty can easily be overcome, however, by substituting for the series coil of a given machine a coil having the same resistance and current capacity. This substitution enables the series coil to be taken out of the circuit and the whole machine may thus be disconnected from the others when it is not working, at the same time securing the proper compounding effect.

There is still another important point besides the one discussed by Prof. Roberts and it is due to the same causes. This is the fact that the series coil of a dynamo should be connected to the equalizer *before* the armature of the machine is connected to the circuit in parallel with other generators. If on the other hand, the voltage of the machine is made to agree with that of the circuit, the field magnet being excited by the shunt coils only, then its E. M. F. will suddenly rise when the machine is connected to the circuit and the current flows through its series coil. This will cause the machine to take a large load instantly, instead of having it gradually applied by adjusting the rheostat in the shunt field circuit. Thus it will be seen that both these troubles that may arise in connecting compound dynamos in parallel, are avoided by having the series coils permanently connected through the equalizer.

Columbia College, New York. F. B. Crocker.

Signalling Through Space.

To the Editor of The Electrical World:

Sir:—In your issue of November 17, Mr. Thos. D. Lockwood refers to my note of the previous issue relative to an instance of telephonic induction from a telegraph line to a short telephone line through the medium of a second telegraph line at right angles to the first. He regards as more probable that conduction existed between the two telegraph lines due to breakage across supports, etc.

I had purposely disregarded this view of the matter because the climatic conditions were much more favorable to inductive effects than to any breakage existing over or across supports, etc. My original views of the matter were further strengthened because of the fact that I could plainly hear the humming of street car motors in Harrisburg, as they gradually absorbed more power from the trolley wire, and again as it was decreased, thus producing a varying electrostatic field in the vicinity of the telegraph line. Of course, the field in this case is a very strong one, but the principle remains the same; and I only adhere to the inductive effect between the telegraph lines because of the fact that the atmosphere on that particular day was very clear and dry, rendering conduction the least probable of the two.

Pittsburgh, Pa. E. A. Grissinger.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

COMPILED FROM PRINCIPAL FOREIGN ELECTRICAL JOURNALS

BY CARL HERING

Note.—Owing to the frequent delays in the transatlantic mails during the winter months, abstracts and references of some of the foreign journals, chiefly the more important ones from England and Germany, cannot be published as promptly as heretofore.

ELECTRO-PHYSICS.

Voleta's Fundamental Experiment.—In a lecture briefly abstracted in the "Zeit. feur Elek." Nov. 1, the following experiments by Prof. Stricker are described. It was shown that the generation of electricity by a pair of plates took place not only when they are separated after having been in contact, the way in which the experiment is usually shown, but also when they are brought near to each other and then suddenly separated; actual contact is therefore not necessary; that the layer of air serves as an insulator and not as a moist substance, is shown by the fact that if it had acted in the latter capacity, the zinc pole would have to be negative, but in this experiment it is positive, whether the plates have touched each other or not. That contact is not necessary he also showed as follows: If, instead of separating the plates, they are suddenly approached, electricity will be generated as before but with opposite signs. The experiment was then made to show the potential of a metal in a liquid by connecting the liquid with the earth by means of a wet string; in this way zinc in zinc sulphate was negative and copper in copper sulphate was positive. These and other experiments were shown to illustrate the theory of Stricker that currents of different signs pass through a circuit from both poles, each one passing with a gradual decrease of its energy; the two currents are added when they flow in opposite directions from the same conductor; if a single branch connection is made, only the difference between the two currents will pass through it; a negative current is also shown to have a much greater action on the muscles than a positive current.

Refraction and Dispersion of Rays of Electric Force.—A paper by Messrs. Garbasso & Aschkinass, from the "Wied. Ann.," No. 11, 1894, is published in the Lond. "Elec.," Nov. 9. They show that the rays proceeding from a Hertzian primary conductor may be analyzed into a spectrum by a prism made up of resonators, and from this they draw the two deductions: (a) The emitted rays of electric force may be regarded from a physical point of view, not necessarily as monochromatic, but as composite with about the same degree of justification as white light; (b) Helmholtz's theory of chromatic dispersion gains further support by their results. Editorially it is claimed that it is not certain that their first conclusion is really proved by their researches and that the waves emitted by the oscillator are not shown to be compounded like the waves of white light.

Propagation of Light.—An article from the "Wied. Ann.," vol. 50, page 361 (1893) by Mr. Reiff, is reprinted in "L'Eclairage Elec.," Oct. 27, the title being "The Propagation of Light Through Mediums According to the Electromagnetic Theory of Light;" it is mathematical in character.

MAGNETISM.

Magnetic Properties of Asbestos.—The subject is further discussed by Mr. Bleekrode in the Lond. "Elec. Rev.," Nov. 9. He states that Brugman discovered this quality of asbestos as early as 1778, and that Faraday also pronounced asbestos a feebly magnetic substance. He describes experiments made by himself, showing that asbestos, and especially in the form of mill-board, could be raised some distance by a magnet, that it acquired magnetic polarity after having been in contact with a magnet, and that when in contact with one pole of a magnet the other end of the asbestos would attract iron filings. Electric attraction he says has nothing to do with these effects; he differs from Mr. Swinton, who ascribes the magnetic quality to the presence of iron, as iron compounds are only feebly magnetic and that even the sesquioxide of iron, although composed of two strong magnetic substances is apparently neutral in comparison with asbestos; he suggests that some magnetic substance may perhaps be introduced in the manufacture of asbestos cardboard. Mr. Hancock, in a letter published in the same issue, endeavors to explain that asbestos is not magnetic.

Magnetarium.—A brief description of this globe made to imitate the earth as a magnet (see Digest, April 7) is published in the Lond. "Elec. Rev.," Nov. 9.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Standards of Measurments.—In the Lond. "Elec. Rev.," Nov. 9, Lord Kelvin replies to a recent statement made in that journal regarding the possible effect of vibrations on the ligaments of his electro-dynamic balance used in the Board of Trade Laboratory; he states that no such effect could be produced unless the vibration of the table was "much more than enough to cause the ink to jump out of an ink bottle placed beside it on the same table." He describes how the ligament is aged by a severe process by the maker, with weights of 4 to 56 lbs. kept on for 2½ days; in some cases a slight stretching has been found after long continued heating by an electric current; the sights at the two ends of the beam makes it impossible that any elongation could pass unperceived and means are provided for readjustment.

Measuring the Armature Loss and Efficieiency of Motors and Generators—The "Elek. Zeit.," Nov. 1, contains a long article of a practical nature by Mr. Grau, in which he shows how the total losses in the armature and the efficiency of the whole machine may be determined by a purely electrical process (although not a very simple one). Each of the five different losses in the armature are determined separately; for the hysteresis loss (in watts) in a two-pole machine he gives the formula

$$0.002\,\mathfrak{B}^{1.6}\,V\frac{n}{6\times 10^8}$$

in which $\mathfrak{B}$ is the magnetic induction in the armature, V its volume in cubic centimeters and n the number of revolutions per minute; the loss due to bearing friction is determined experimentally; the loss due to the short-circuiting of the armature coils by the brushes (presumably in watts) may be calculated by the formula

$$\frac{n\,L\,C^2}{60\times 4}$$

in which n is the number of revolutions per minute, L the self-induction coefficient (in henrys) of the whole armature and C the current in amperes; the loss due to Foucault currents can be determined only approximately by the methods of Kapp, Hummel and Mordey; in the present article he shows how this latter loss may be determined accurately by the following method. The loss due to Foucault currents is, according to Clausius, for the same excitation, proportional to the square of the number of revolutions, or at a constant speed, to the square of the field strength, and represented by the formula (presumably in watts) cN^2 in which N is the total number of lines of force and c is a constant, the value of which he determines by the following method: (its value is extremely small, being in about the 10th and 11th decimal places). The dynamo to be measured is coupled directly to a motor, both being separately excited from an outside source; around the armature of the dynamo there is a single turn of wire which does not revolve, the ends of which are connected to a ballistic galvanometer; the self-induction was measured at the required speed and cur- paragraph); the power transmitted by the motor is then equal to the sum of all those losses added to the output of the dynamo; the excitation of the dynamo is then changed, but that of the motor, as also the speed, remain unchanged, the load on the dynamo being altered until the power delivered to the motor is (exactly) the same as in the first case, and therefore also that transmitted to the dynamo, and all the losses in the dynamo except that due to power friction, will therefore have different values; from the two simple equations giving the sum of these powers and losses the value of c above mentioned, may then be calculated, provided all the other quantities are known. He describes in detail a series of tests illustrating the method, including also a method for determining the bearing friction; it is very essential in determining c that the measurements be made very accurately and the speed and the power delivered to the motor be exactly the same (for instance, an error of less than 1 per cent. in the power delivered to the motor causes a difference of about 15 per cent. in the value of c in the particular problem given); all the losses being thus determined, the total efficiency may then readily be calculated. In practice it is required to determine the efficiency for different loads at constant excitation; in this case the test is carried out in the same way, both machines being separately excited, but the excitation in both is now kept constant; the number of lines of force in the motor is determined as before while running, by opening and closing the exciting current and measuring the induction with a ballistic galvanometer.

Photometric Units and Quantities.—In giving the symbols suggested by Hospitalier (see Digest, Nov. 10) the Lond. "Elec.," Nov. 9, says in regard to the appropriation of nonpareil heavy Gothic type for these units, "the country which has done by far the most work in modern 'magnetics' should by courtesy and by virtue of the good work accomplished be given a predominant voice in the choice of symbols."

Photometric Magnitudes and Units.—A translation of the paper by Prof. Blondel, abstracted in the Digest, Aug. 11, and referred to a

number of times since, is published by the London "Electrician" in pamphlet form, it being a reprint from that journal of Sept. 28, 1894.

Measuring the Degree of Incandescence of Lamps.—A few figures from Mr. Crova's paper (see Digest, Nov. 17) are published in the Lond. "Elec. Rev.," Nov. 9.

Measuring the Self-induction of a Dynamo Armature.—The Joubert method is briefly described by Mr. Grau in the "Elek. Zeit.," Nov. 1. If R is the resistance and L the self-induction coefficient of the armature, a known inductionless resistance r is connected in series with it and an alternating current C of the required strength is sent through it, and the difference of potential is measured at the ends of the resistance R and then at those of r; if these values are called E and e the following equation

$$C = \frac{E}{\sqrt{R^2 + w^2 L^2}} = \frac{e}{r}$$

will be true, from which the value of L is determined (w is apparently equal to 2π times the frequency).

Standard of Light.—The Lond. "Elec.," Nov. 9, publishes a translation in abstract of the paper by Messrs. Lummer & Kurlbaum, abstracted in the Digest, June 2 and Sept. 22.

New Standard of Light.—A lecture by Mr. Dibdin is briefly abstracted in the Lond. "Elec.," Nov. 9; it contains apparently nothing new.

Localizing Faults in Submarine Cables.—In accordance with the request of Prof. Jamiesen some students tried both of the methods mentioned by Mr. Jones and Prof. Jamiesen in the recent discussion (see in the late issues of the Digest), a cable tank and an artificial fault in the cable; the results are briefly stated in the Lond. "Elec. Rev.," Nov. 9. They found that about 50 per cent. more time was taken to connect up for Mr. Jones' method. than for the other, but the time for making the two tests was about the same; they state that there is no doubt that where earth or fault currents are present or where very high resistance slides cannot be obtained, the Jones' method is preferable; care should be taken that the condensers do not leak and in a comparative test the dielectrics of the condensers should be of the same material; the method described by Prof. Jamieson gave results about 2 per cent. nearer to the correct value; they prefer the null methods to that of discharges from a condenser.

Calorimetric Measurements.—In a Physical Society paper on the influence of temperature on the specific heat of aniline by Mr. Griffiths, pulished in the Lond. "Elec.," Nov. 9, he describes some delicate calorimetric measurements made with the aid of electrical apparatus.

Meter Testing.—The charges made by the London County Council for testing meters of various descriptions. are given in the Lond. "Elec. Eng.," Nov. 9.

Conductivity of Ethers.—A paper from the Italian by Mr. Bartoli, published in "L'Eclairage Elec.," Oct. 27, gives the results of observations on the influence of temperature on the electric conductivity of composite ethers.

DYNAMOS AND MOTORS.

Design of Large Alternators.—In the Lond. "Elec. Rev.," Nov. 9, Mr. Kennedy replies to the statements of Mr. Armstrong (see Digest, last week). His reply is briefly as follows: The statement that few machines are made without iron in the armature applies to America only, as in England this class of machine is made by the most important firms, and more of them are in use than any other type; no comparison can be made between costs on account of the protection in America; it is a great mistake to take cast iron as the material in solid field magnets, as it is used only for the framework, the best soft iron being always used for the cores and poles and he has not yet heard of laminated iron which can be used at a higher induction than good solid soft iron; in his country laminated field magnets cost at least double and often three times as much as those with soft iron cores; to compare laminations with cast iron is absurd; it should be compared with solid soft iron of the best quality or with the softest cast steel, which is not more than 10 per cent. below laminations in permeability and susceptibility; in discussing leakage it is not necessary to distinguish between armature and field magnets, and he asks where the leakage can occur in an ironclad field of the Mordey type, in which he has never been able to discover any, while in radial laminated poles he finds leakage from 25 to 50 per cent.; eddy currents exist in all dynamos and are not greater in a flat ring coreless armature than in the huge laminated structures in other machines; the English believe in great field strength and weak armature reaction; the primary object of the field coils is to produce the greatest induction through the generating coils, a fact which he says is often forgotten; regarding synchronizing he thinks one machine is as good as another, and he believes that the induction of the armature has nothing to do with the question, but if it has it is cheaper to obtain it by induction coils in the circuit; mechanical momentum has more to do with the question; any electrician ought to be able to synchronize any alternator whatever its construction may be; he denies that coreless armatures cannot be made sufficiently strong for all practical purposes, hundreds of them having been at work for ten years; coreless armatures and an ironclad field of the best soft steel can be made for just one-half the cost of a radial pole machine with laminated cores for the same output and speed, the coreless one weighing less; he believes that the exciter is really the weak spot in the alternator and is the cause of most of the trouble in synchronizing; he believes the coreless armature is the best and that the future will see all large continuous current machines made also with coreless armatures; laminations in large machines will become a thing of the past.

The same issue contains a long reply to Mr. Armstrong's letter by Mr. Raworth; it is chiefly personal in character and is in defense of the Mordey alternator. He says that the breaking of the field of an ironclad alternator need not throw it out of step; there are 350 Mordey machines in daily use, and he states that the sudden rush of current through the armature when the field current is broken has not taken place once in all of these; he denies that very close regulation of the field current is required, and states that not one of the Mordey alternators has ever yet dropped out of phase; alternators without iron outnumber other kinds manufactured in England two to one.

Ventilating Armatures.—A device by Mr. Poeschmann is described and illustrated in "L'Eclairage Elec.," Oct. 27; the pulley contains a fan ventilator which is connected by tubes leading through the bearing into the space around the armature and thence out at the commutator.

TRANSFORMERS.

Impedance of Transformers.—An editorial in the Lond. "Elec. Rev.," Nov. 9, calls attention to a paper by Mr. Rimington in "Proc. of the Phys. Soc." vol. 13, October, 1894. It contains the account of an investigation of the behavior of air-core transformers when the frequency is below a certain critical value; the investigation is a purely geometric one and demonstrates conclusively that under certain conditions the apparent impedance of the primary is not diminished on closing the secondary, as is usually supposed; among the cases discussed are that of an identical primary and secondary with magnetic leakage, that of two coils with different time constants without magnetic leakage and that of two coils with different time constants with magnetic leakage; presumably the reason why increased impedance on closing the secondary of ordinary transformers has not been noticed is because their lag angles are very large.

Principles of Transformer Design.—A series of articles by Mr. Alfred Still is begun in the Lond. "Elec.," Nov. 9; it is intended chiefly for students and will give a short, concise account of the principles underlying the design of transformers and choking coils; the present portion is somewhat elementary in character.

ARC AND INCANDESCENT LIGHTS.

Researches with the Electric Arc.—The first part of a paper read before the Austrian Academy of Sciences by Dr. Sahulka, is abtracted at some length in the "Zeit. feur Elek.," Nov. 1. It is known that between the positive electrode and the arc there is a large voltage and between the arc and the negative a small voltage, which is explained by the supposition that there are electromotive forces in the arc; with the alternating current these voltages are the same; to show that they are due to a counter electromotive force and not to a resistance, it is best to use an alternating current, as in that case these voltages can be measured apart from those due to resistance; it is also best to use two different materials for generating the arc; such an experiment will show that the arc in that case acts like a source of a continuous E. M. F. generating a continuous current; if the arc is formed between like horizontal electrodes, there will be no continuous current generated, but the arc will be negative as compared with either of the two electrodes; in a shunt circuit between the arc and one electrode a continuous current will flow; these results show that there is a true E. M. F. in the arc. He then describes in detail a series of measurements made with an alternating current arc between iron and carbon, a number of different measuring instruments being connected in series and in shunt by means of which the continuous current element and the alternating current element may be measured separately; these show that a continuous current flows through the alternating current circuit made up of the arc and the secondary of the transformer; the results of a number of measurements are given, from which it appears, among other things, that the continuous current was about half of the total current indicated by the electrodynamometer; also that the continuous E. M. F. generated by the arc was about 37.7 volts, the alternating voltage being about 75 volts. The generation of a continuous current might also be explained by the supposition that the resistances in the arc changes, as the iron and the copper will be vaporized alternately. The article is to be continued.

Alternating Arc Light Carbons.—An explanation of the fact that the consumption of the two carbons in the alternating arc is unequal, is given by Messrs. Bedell and Crehore in the Lond. "Elec.," Nov. 9; they explain it on the supposition that the energy in successive semi-periods is not equal.

Holophane Globes.—A general description, not including the theory, is given by Mr. Gilbert in "L'Eclairage Elec." Oct. 27; several illustrations, though not very good ones, are given; the globe is apparently the same one described in the Digest, Nov. 10.

Spectroscopic Comparison of Different Lights.—Some of the results

of Mr. Muetzel's paper, abstracted in the Digest, Sept. 22, are published in the Lond. "Elec. Rev.," Nov. 9.

ELECTRIC RAILWAYS.

Conduit System.—According to the "Elek. Anz.," Nov. 4, the Siemens & Halske Company have adopted the Lachmann system, in which there is a slotted conduit made up of sections, the top being formed like an inverted box, with the object of preventing any water in the conduit from extending into this box by virtue of the air in it; the conduit and even the street may therefore be immersed in water, but the air confined in this box will keep the water from reaching the wire which is supported therein. Trials made with this system are said to have been very successful; it is claimed that the cost will not be greater than that of the overhead trolley system, probably even less.

Electric Traction in Berlin.—The 'Elek. Zeit.," Nov. 8, announces that the Municpal authorities of Berlin have decided to favor the transformation of horse traction in that city into electric traction, but whether the trolley system, the underground conduit or the accumulator system is to be used is not decided.

Light Railways.—A letter from the Board of Trade to various commercial bodies, discussing the introduction of light railways is published in the Lond. "Elec. Rev." Nov. 9. The Lond. "Elec." Nov. 9 publishes a long discussion of this letter; also a communication and a letter from the London "Times"

Electric Traction.—An Institution paper by Messrs. Blackwell & Dawson on "Electric Traction with Special Reference to the Installation of Elevated Conductors" is published in the Lond. "Elec. Eng." Nov. 9 with a large number of illustrations, and in part in the Lond. "Elec.;" it appears to consist principally of a description of American practice.

Liverpool Railway.—A correspondent to the Lond. "Elec. Rev." Nov. 9 suggests how the much criticized efficiency of 88 per cent. may be reduced to a "reasonable" quantity and obtains 68 per cent.

CENTRAL STATIONS, PLANTS, SYSTEMS AND APPLIANCES.

Accumulator Station.—The "Zeit. feur Elek.," Nov. 1, publishes an article by Mr. Strauss describing an installation at Kiiew containing 72 E. P. S. cells; from a table of outputs and efficiences covering a period of nearly three years, the average ampere-hour efficiency was 83 per cent., and the watt-hour efficiency 68 per cent., during which time they were charged and discharged almost daily; no important repairs were made during that time.

Parallel Running of Overcompounded Machines.—In a communication by Mr. Phillimore to the Lond. "Elec.," Nov. 9, he describes briefly a method which is claimed to be perfectly automatic, but which necessitates the use of as many pairs of leads between the machines as there are machines.

Southport.—A description with good illustrations is published in the Lond. "Elec. Rev.," Nov. 9; an alternating current system with 2,000 volts and sub-stations is used; there is nothing essentially new in principle. A long and profusely illustrated description is published in the Lond. "Elec Eng.," Nov. 9.

Bolton.—A description with good illustrations, is published in the Lond. "Elec. Rev.," Nov. 9.

Municipal Electric Lighting.—A description of the Hampstead station by W. H. Preece, is published in the Lond. "Elec.," Nov. 9.

Train Lighting.—An installation on a French railway is described in "L'Elec.," Nov. 3, giving data and costs.

Design and Specification for Electric Lighting Works.—In the Digest, Oct. 27, attention was called to a series of articles by Messrs. Pentland & Gibbings, which is being published in London "Electricity," beginning with Oct. 5. The remark that it appeared to be a reprint of a book should have read that it appeared to be an advance publication of a book. The editor of the journal has stated to us that the series is entirely original and is being written for that paper; it is intended for architects and civil engineers, to enable them to design, specify, and inspect small installations.

Gas Engines—The leading editorial in the Lond. "Elec. Rev." Nov. 9, discusses recent publications regarding gas engine competition.

WIRES, WIRING AND CONDUITS.

Inductance in Aerial Lines.—Mr. Blondel's mathematical article is continued in "L'Eclairage Elec.," Oct. 27; he discusses the applications.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Telegraphing Without Metallic Conductors.—The system of Mr. Rathenau, mentioned in the Digest last week, is described with illustrations in the "Elek. Zeit.," Nov. 8. After mentioning briefly the results accomplished by Preece and Stevenson, he describes his system which he claims is based on conduction; if two plates are immersed near the shore of a river, lake or ocean, some distance apart from each other, and if a current be passed from one to the other through a land line, the return current through the water will pass through paths somewhat similar to those of magnetic lines of force; if a good conductor is placed parallel to these lines some distance from the shore it will, as it were, condense the current paths which are in its neighborhood; the currents in this circuit are then passed through some suitable receiver; it is claimed that there is, therefore, no induction, but a mere conduction. In the tests the shore line circuit included a battery of 55 accumulators, an interrupter, a telegraphic key, a resistance and measuring instruments; the receiving line held between two boats, was about 1,500 to 3,000 ft. long, terminated in two zinc plates and had two telephones in its circuit; the experimental plant was installed in the River Havel. The regularly pulsating current produces a humming in the telephone; the Morse alphabet is used; a number of tests were made, but the apparatus was not well adapted for them; only 3 amperes and 150 interruptions could be used, while owing to the poor conductivity of the water, the surface of the plates had to be 15 sq. m.; in spite of this however, signals were clearly received at 2.7 miles with a distance between the primary electrodes equal to about 1,600 ft.; (Preece communicated to a distance of 3.9 miles with a length of primary wire of 14,000 ft.); the limit of signalling was, however, by no means reached. Lord Rayleigh has shown that with oscillations of about 600, the telephone is about 600 times as sensitive as with 130 periods per second, and for this reason he suggests making the interruptions with a tuned reed and also to tune the telephone membrane to the same note; the former may also be accomplished by an alternating current machine of the desired frequency; tuning the receiver and transmitter will also enable different communications to be held through the same body of water; the resistance of the secondary circuit must be reduced as much as possible as both theory and experiments have shown that the current decreases more rapidly than in proportion to the increase of resistance. One of the most important and most difficult problems is the construction of the call, for the solution of which he suggests increasing the currents by a microphone placed on the membrane and operating a delicate relay; such an apparatus is now under construction; regarding the recording of the signals, an instrument was suggested based on the Wien optical telephone, in which the acoustic signals are transformed into optical ones and then registered photographically; in conclusion he believes that by proper proportioning of the various parts and by finding the best conditions, the distance may be increased very materially. In an editorial discussion it is stated that the results are far superior to those of Stevenson; the present method has the advantage of simplicity and the necessary apparatus can be erected quickly and easily, for which reason it may be of importance in field telegraphy. The question, how much of the transmission is due to induction and how much to conduction, is of importance in further researches; a method to determine this is suggested.

Microphone.—Mr. Munro in a communication to the Lond. "Elec." Nov. 9, states that he proved in 1883, that besides the sonorous vibrations of the points, there is an attraction and repulsion due to the current and varying with its strength; also that the microphone is reversible, and can, therefore, be used both as a receiver and transmitter; the attraction and repulsion can be seen on a large scale in the jumping of carbons in an arc lamp; he believes that the Edison motograph and Gray's physiological telephone are based on this same phenomenon.

Induction in Telephone Circuits.—The paper mentioned in the Digest, Nov. 10, is concluded in the "Zeit. feur Elek.," Nov. 1.

Indian Telegraphs.—The Lond. "Elec. Eng.,' Nov. 9, contains a short paragraph giving some statistical information.

ELECTRO-CHEMISTRY.

Aluminium Sulphide and Clay as a Source of Aluminium.—According to the Lond. "Elec. Rev.," Nov. 9, Mr. Boucherer showed several years ago that aluminium sulphide is a convenient source for preparing the pure metal electrically; one of the advantages over the oxide is that less energy is required, the carbon is not attacked and the sulphur can be recovered. In this connection attention is called to a paper by Mr. Gruy in the "Zeit. feur Angewandte Chemie," 1894, page 290, in which he describes a new process for producing the sulphide; a bath is made of the double chloride of sodium and aluminium added to fused sodium sulphide, forming aluminium sulphide and sodium chloride; the fluoride of aluminium behaves in the same manner as the chloride; clay may be used as a raw material, aluminium sulphate being formed when it is decomposed with sulphuric acid, the sulphate being fused with sodium fluoride, giving aluminium fluoride, from which as before the sulphide may be obtained.

Electro-deposition of Gold.—In the Lond. "Elec. Rev.," Nov. 9, Mr. Andreoli discusses and criticises unfavorably a recent paper by Mr. von Gernet on the Siemens process. The article does not permit of being abstracted, but he intimates that the process could be greatly improved and gives some figures regarding the works at Worcester.

Cadmium Yellow.—According to a note in "L'Elec.," Nov. 3, it may be produced by electrolysing a solution of chloride of sodium between cadmium electrodes, passing sulphuretted hydrogen through the bath, the color varying with the conditions; antimony vermilion may be produced in the same way by using electrodes of antimony.

New Accumulator.—A brief description of the Taulignе accumulator (see Digest, July 7), is published in "L'Eclairage Elec.," Oct. 27; no more information is given than is contained in the Digest abstract.

Accumulators.—The article of Mr. Leroy (see Digest, Nov. 3), is abstracted in the Lond. "Elec. Rev.," Nov. 9.

MISCELLANEOUS.

Central Station Currents in Electro-therapeutics.—"L'Elec.," Nov. 3, publishes an article by Mr. Meylan, in which he discusses some important points in the application of alternating currents from central stations for therapeutical purposes. He describes the installation of Messrs. Gautier and Larat, in which such currents have been used for a number of years; d'Arsonval has shown that peculiar effects are produced in organisms by sine currents in which for a given maximum intensity the instantaneous variations are smallest; an incomparably larger current can be taken than if the current is of the faradic kind. The currents used in an electric bath should not exceed 100 milliamperes and more often 40 to 60 milliamperes at 10 to 15 volts, and it is therefore necessary to reduce the 100 volts of the lighting circuit; he suggests as the best means, a transformer for lowering to 15 volts, this current being then reduced as much as is desired by another transformer whose primary is movable as usual; there is then never any fear of obtaining a shock; in the method of Gautier and Larat, however, the voltage is reduced by a choking coil in series and then transformed by means of a small coil; opening the switch in that case could, under certain conditions, give a very serious shock. He then gives a number of measurements made with such baths with electrodes having an area of 700 square centimeters; the results show that the resistance of the water in a bath-tub was about 177 ohms; they showed that the voltage, if a choking coil is used, varies considerably with the resistance of the secondary circuit; their measurements in another installation are given, and from these the resistance of the human body in the bath tub was found to be 1,360 ohms, while the resistance of the water which it displaces was 935 ohms, showing that the human body offers a somewhat greater resistance than the same volume of water; the current which passed through the body was about one-tenth of the total, in this case 10 milliamperes, the frequency being 40, and this should be considered as the maximum for a normal person; a very robust person could stand only with difficulty a sinusoidal current of 13 milliamperes with a frequency of 60, with two large electrodes in the hands, the resistance of the body being 2,000 ohms. He shows the advantages of using two transformers instead of a choking coil and a transformer, and gives as another reason that the waves of the final current are nearly like those of the original, while the introduction of the choking coil modifies the form of the current very considerably; this is shown by a set of curves, from which he concludes that the physiological effects of the irregular curve, produced by a choking coil, are very different from those produced by a sine current, as the curve of the former passes quickly from a positive maximum to zero and very slowly from zero to the negative maximum; he concludes that in general the choking coils modify the curve less the more their magnetic circuit is opened, all other things being equal, especially the ratio of the resistance to the self-induction; it is an advantage also to have the iron circuit of the transformer an open one.

Moonlight Tables for January, 1895.

Herewith we give Mr. H. W. Frund's tables of lighting hours for the month of January under his modified form of moonlight schedule.

TABLE NO. 1.
Standard Moonlight System.

Date.	Light.	Date.	Exting.
1	9.10 P. M.	2	6.20 A. M.
2	10.10 "	3	6.20 "
3	11.10 "	4	6.20 "
4			
5	12.10 A. M.	5	6.20 A. M.
6	1.10 "	6	6.20 "
7	2.20 "	7	6.20 "
8	3.30 "	8	6.20 "
9	4.50 "	9	6.20 "
10	No light.	10	No light.
11	"	11	"
12	5.30 P. M.	12	7.50 P. M.
13	5.30 "	13	9.00 "
14	5.30 "	14	10.20 "
15	5.30 "	15	11.30 "
16	5.30 "	17	12.50 A. M.
17	5.30 "	18	1.50 "
18	5.30 "	19	3.00 "
19	5.30 "	20	4.10 "
20	5.40 "	21	5.10 "
21	5.40 "	22	6.10 "
22	5.40 "	23	6.10 "
23	5.40 "	24	6.10 "
24	5.40 "	25	6.10 "
25	5.40 "	26	6.10 "
26	5.40 "	27	6.10 "
27	5.40 "	28	6.10 "
28	5.40 "	29	6.10 "
29	8.00 "	30	6.10 "
30	9.00 "	31	6.10 "
31	10.00 "	1	6.10 "

TABLE NO. 2.
Frund's New Moonlight System.

Date.	Light.	Date.	Exting.
1	5.10 P. M.	2	6.20 A.M.
2	5.10 "	3	6.20 "
3	5.10 "	4	6.20 "
4	5.20 "	5	6.20 "
5	5.20 "	5	12.00 M.
6	1.10 A. M.	6	6.20 A.M.
6	5.20 P. M.	6	12.00 M.
7	2.20 A. M.	7	6.20 AM.
7	5.20 P. M.	7	12.00 M.
8	5.20 "	8	"
9	5.20 "	9	"
10	5.20 "	10	"
11	5.20 "	11	"
12	5.30 P. M.	12	"
13	5.30 "	13	"
14	5.30 "	14	"
15	5.30 "	15	"
16	5.30 "	17	12.50A.M.
17	5.30 "	18	1.50 "
18	5.30 "	19	3.00 "
19	5.30 "	20	4.10 "
20	5.40 "	21	5.10 "
21	5.40 "	22	6.10 "
22	5.40 "	23	6.10 "
23	5.40 "	24	6.10 "
24	5.40 "	25	6.10 "
25	5.40 "	26	6.10 "
26	5.40 "	27	6.10 "
27	5.40 "	28	6.10 "
28	5.40 "	29	6.10 "
29	5.50 "	30	6.10 "
30	5.50 "	31	6.10 "
31	5.50 "	1	6.10 "

NOTE.—These schedules are made up on sun time. Where standard time is used, and it varies considerably from sun time, the proper deduction or addition must be made to all the times here given.

The Physical Review.

The Physical Review for November-December, 1894, contains a frontispiece portrait of Professor von Helmholtz and a very appreciative biographical sketch from the pen of Professor E. L. Nichols, who was one of his pupils. Dr. Frederick Bedell and Carl Kinsley have an extensive article on "A Study of the Residual Charges of Condensers and heir Dependence upon Temperatures." This does not appear to differ from the paper on same subject read by the same authors before the American Institute of Electrical Engineers. In the note "On Some Magnetic Characteristics of Iridium," by Professor S. H. Brackett, the author finds that iridium as at present manufactured is presumably different from that used by Faraday as it possesses magnetic properties, very low permeability and great coercitive force with a high intensity of magnetism, were plainly exhibited by the specimens of iridium with which he experimented, and these characteristics are said to be consistent with the known physical laws on this subject. The paper on "A General Theory of the Glow Lamp," by H. S. Weber, of which we have published an abstract, appears to be concluded in this number, but we cannot be certain as the preceding section, beyond the addition of a Roman numeral to its title, had no indication that it was to be continued.

A Patent for Sale.

As an amusing example of the grist that sometimes comes to an editorial mill we print the following:

"As you will see from the inclosed circular, I have a good invention —read on: I haven't the money to work it like I want to, so I am going to make a *few good* papers this liberal offer:

"If you will cause me to sell my right to the invention, before the patent is granted, for $20,000, I will give you $10,000. It is worth $20,000 if it is worth anything, but if you cause me to sell it for $10,000 you get $5,000.

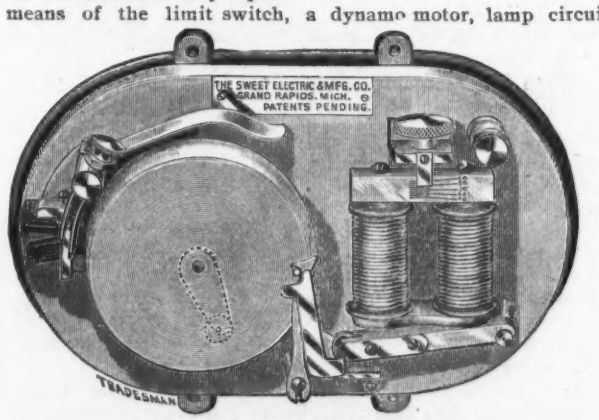
"Are you competent to be in the race? It would be with you whether you won or not. I cannot authorize you to sell the right as this might cause a double sale.

"If you accept this rare offer I will keep you posted with ideas. The advertisement would be worth three times the cost to your paper. You cannot lose anything on this. I will sell on no terms except Spot Cash."

Station Limit Switch.

We illustrate herewith an automatic limit switch, which, it is claimed by the makers, the Sweet Electric & Mfg. Company, Grand Rapids, Mich., never fails to open on a predetermined point, and is accurate and positive in its action; the adjustment is simple, there are no complicated parts to wear out, and it will last a lifetime. The breaking of the current between carbons is done in such a manner that when the metal contact is broken there is still another contact between carbons which are rotating, thus throwing in a resistance before the final point of breaking; this greatly reduces the volume of current, and, when the contact is finally broken, leaves no chance for the formation of carbon vapor as the motion is very rapid.

By means of the limit switch, a dynamo motor, lamp circuit, or

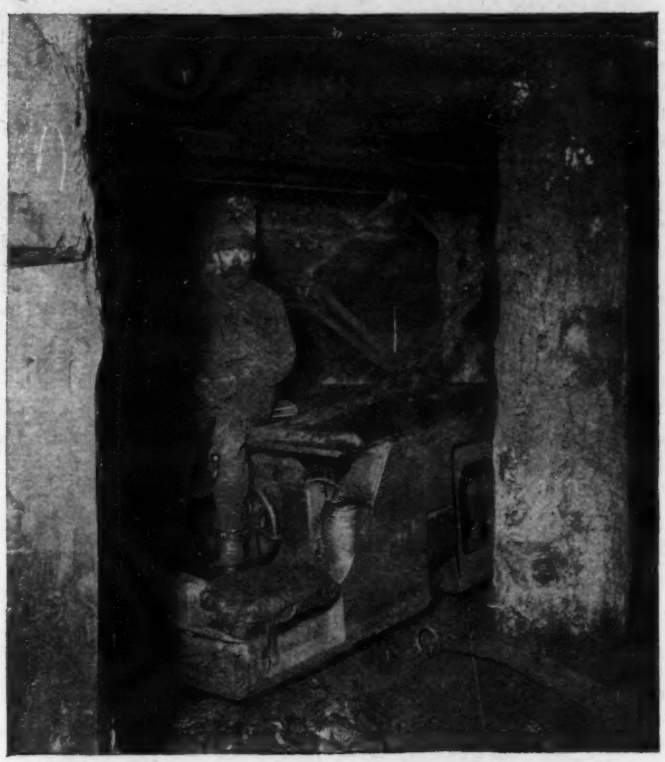


STATION LIMIT SWITCH.

whatever service it is in connection with, is entirely independent, for the reason that it is adjustable to one-tenth of an ampere and the current cannot exceed the amount to which the switch is adjusted without opening the circuit. This type of non-arcing limit switch is especially adapted for street railway motors, and is designed to take the place of fuse boxes; for double equipments it can be put in circuit with each motor, so that if a ground or short circuit occur, the switch cuts out the defective motor, leaving the good motor still in circuit for operation. The switch does not occupy very much space, being only 3x8x11 in. in size, and is circular in form and neat in design; it can be placed anywhere inside or outside of car in any position. The switch when set in position cannot open by any sudden jar whatever, but remains locked until opened by excessive current or otherwise by hand if so desired, there being a small push button on the outside when used as an ordinary cut-out. The adjustment is made by a small thumb screw, and the switches are made from 25 to 200 amperes capacity.

Electric Haulage in a Michigan Mine.

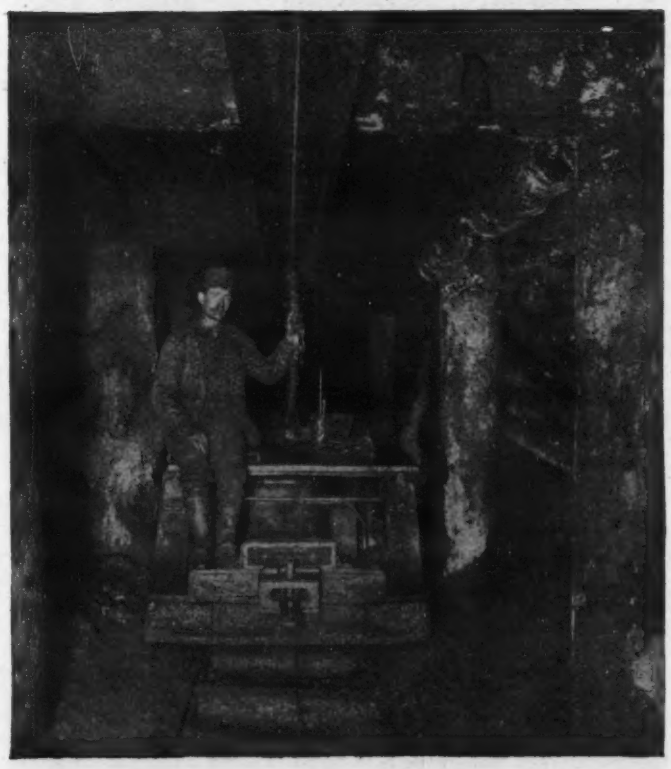
About two years ago the Pittsburg & Lake Angeline Iron Mining Company determined to install an electric plant, after having become convinced of the economy of the step. At the surface, a power house was



MINE HAULAGE ELECTRIC LOCOMOTIVE.

constructed, and a 14x30 Reynolds-Corliss engine erected to drive a D-62-500-volt General Electric bipolar generator. Armored mains are taken down the mine on porcelain insulators, and connected in the usual manner to the trolley wire and track.

The haulage plant proper consists of two General Electric T. M. M.-15.



MINE HAULAGE ELECTRIC LOCOMOTIVE.

30-in. gauge locomotives, each being equipped with two motors. The locomotives are capable of exerting a draw-bar pull of 1,500 lbs. each, at a speed of from six to eight miles an hour. The motors are of the iron-clad waterproof type.

The length of haul is somewhat short for locomotives, but is too long for profitable tramming by men, the distance averaging from 250 to 1,400 feet. The grade is 8 in. in 100 feet in favor of the loaded cars, and the curves are sharp, varying from 12 feet radius up, on account of the narrow veins. No serious delay has occurred since the plant began operation.

The cost of hauling at the present rate of working, which is not up to the capacity of the locomotives, is 2 cents per ton, including oil, waste and repairs.

Flexible Friction Clutch.

The flexible friction clutch we illustrate was taken up for manufacture by the E. W. Bliss Co., 17 Adams street, Brooklyn, N. Y., owing to the

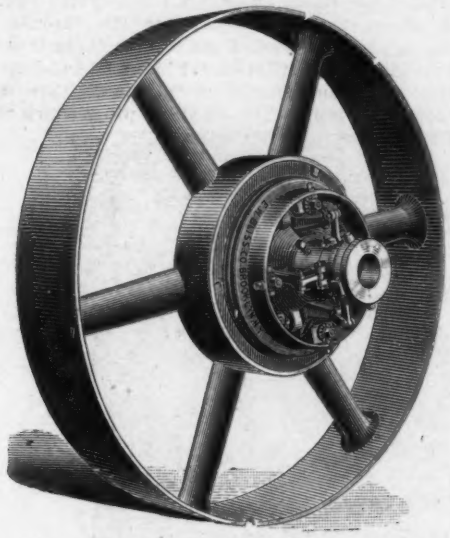


FIG. 1.—FLEXIBLE FRICTION CLUTCH.

difficulty they had experienced in finding for their own demands, which are very extensive, a clutch in the market that fulfilled the highest requirements.

The clutch consists of a friction disc flexibly connected to the pulley, against the sides of which the clutch members grip. Therefore, if the pulley wears out of true on the shaft, no difference results in the operation of the clutch, no undue strains are brought on any of the parts, and no adjustments are necessary to compensate for this wear. There are only two clutch members, one keyed rigidly to the shaft to which the levers are attached, and the other movable. This makes the adjusting

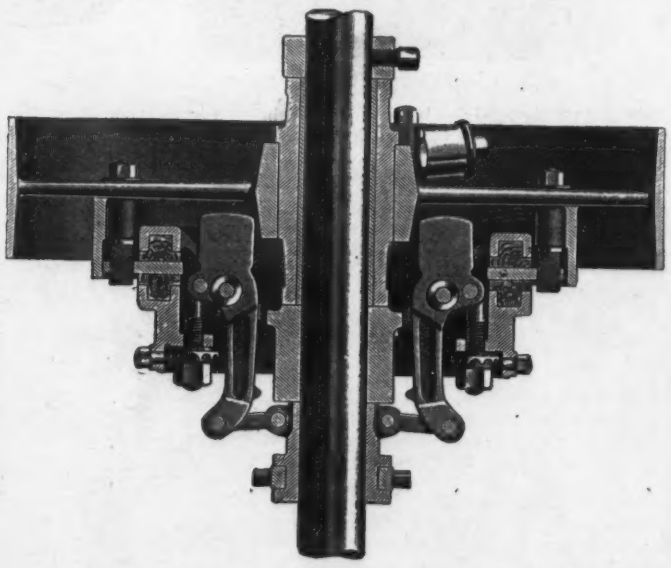


FIG. 2.—SECTION OF FLEXIBLE FRICTION CLUTCH.

of the clutch a very simple matter. The levers are so balanced that at any speed at which the shaft is run the centrifugal force has no tendency to throw the clutch in or out of operation. This is an important point, and one not found in the majority of clutches in the market. The clutch is constructed with very few parts, and is so put together that it cannot get out of order. Its clutching members are circular and concentric with the shaft, the only projecting parts being the levers, so that it not only presents a pleasing appearance when revolving on the shaft, but is in accurate balance, and may be run with safety at any reasonable speed. It is very compact, occupies small space on the shaft, and is so constructed that all parts are interchangeable. By means of a system of

bushings for pulleys so arranged that if, on account of long continued use, or where a poor quality of lubricant is used, the bore becomes worn, the bush can be returned and exchanged for one with a new lining at small expense. The horse-power which the various sizes of clutches will transmit is obtained from actual test by means of a dynamometer especially constructed for the purpose, and it is guaranteed that the clutch attached to any pulley will transmit more power than can be transmitted by a double belt the full width of the pulley.

The Monarch Engine Stop.

The object of the apparatus illustrated herewith, manufactured by the Monarch Engine Stop Company, 34 Maiden lane, New York, is to stop a steam engine or other motor from one or several points near or remote from the engine-room, by simply pressing an electric button, or automatically. A spocket wheel is keyed to the throttle valve stem just behind the valve wheel, and from this a chain leads to the stop, which is enclosed in a cabinet 14 in. x12 in. and 8 in. deep (Fig. 1) and which may be placed at any convenient location, either on the floor, bolted to the ceiling or fastened to the steam pipe, which takes it completely out of the engineer's way. The chain connects with another sprocket wheel attached to the main or driving shaft of the stop. This main shaft is connected with a spring of sufficient power to close any valve, which spring is encased in a brass or phosphor bronze drum cylinder or winding barrel, very similar to the winding device of a watch. The drum is geared to a second horizontal shaft, on the end of which is

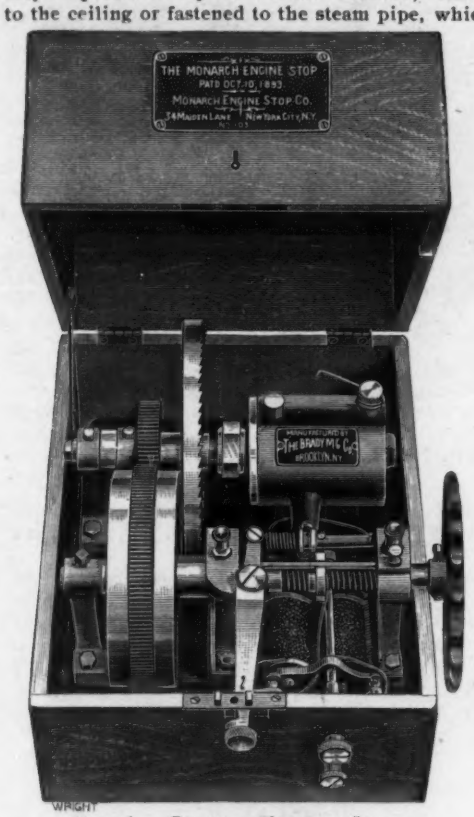


Fig. 1.—Safety Engine Stop.

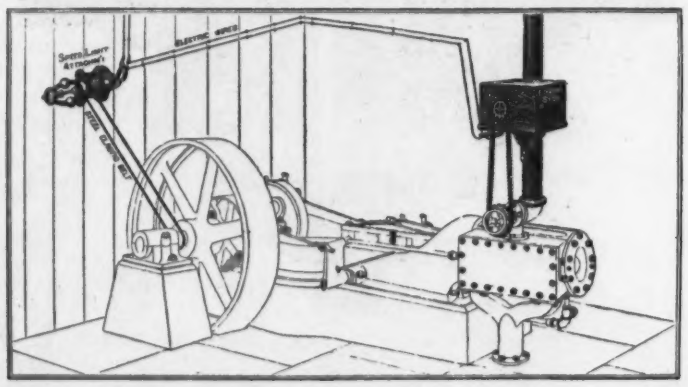


Fig. 2.—Showing Engine Stop Installed.

a piston working in a cushioning chamber or dash pot, filled with glycerine, which controls the closing of the valve by a by-pass, the opening or closing of which regulates the flow of glycerine, and consequently the speed with which the valve closes.

To the piston shaft is attached a ratchet wheel of brass or phosphor bronze, into which enters a sliding paul held in place by a spring controlled by an electric interlocking device, which holds or releases it at the will of the operator.

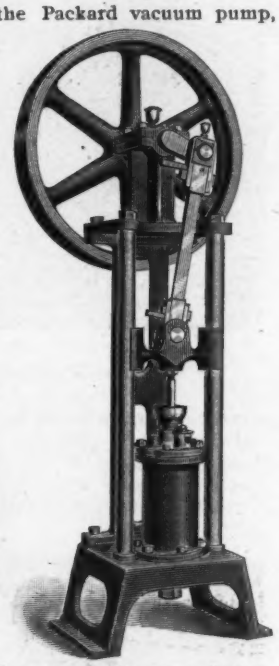
The method of its operation is as follows: The engineer on entering his engine room, presses a button conveniently placed, and if an answering click is heard in the box, he knows that the whole circuit of any number of stations in any part of the works, large or small, is in working order. He next, by opening the throttle, winds the drum spring and by pulling a lever throws the paul into the ratchet, and the machine is ready to work. Now should an accident occur in any portion of the works, near or remote, the simple pressing of a button anywhere on the circuit makes the electric connection, withdraws the paul from the ratchet wheel, which releases the spring, thereby shutting the engine down instantaneously without injury to the valve

The automatic speed limit attachment (shown in Fig. 2) consists of a perpendicular shaft, to which is attached a V pulley connected to ball and springs similar to the ordinary spring governor. This receives its momentum from the main shaft of the engine by a spiral wire belt, which prevents slipping in event of any accelleration of speed. In case of the main belt breaking, or failure for any reason of the governor to control the engine, or the slightest increase of speed beyond the fixed limit (which may be at any number of revolutions desired), the centrifugal force or outward movement of the ball makes the electric circuit, and performs the same office as the pressing of a button anywhere in the circuit.

Improved Vacuum Pump.

We illustrate herewith a new model of the Packard vacuum pump, well-known to incandescent lamp makers, and manufactured by Norman H. Hubbard, 93 Pearl street, Brooklyn, N. Y. These pumps are almost universally used in incandescent lamp factories, where there are over 200 now in use, for the production of the preliminary vacuum in the lamps before the mercurial pump is set to work, for the operation of the mercurial pump and for producing a vacuum in the flashing bottles where the lamp filaments are subjected to the operation of flashing or "treating." The pumps have not heretofore been made with a single cylinder, as they were designed primarily for use in factories where a number of them were required and were, therefore, for the sake of compactness and economy of operation, made with two or three cylinders combined in each pump. To meet the demand for a high grade vacuum pump for use in laboratories and experimental work in lamp factories, the single cylinder design illustrated is now put on the market. For simplicity and compactness this is built with a single cylinder of large diameter and ample length. The frame, as will be seen, is open, making all parts perfectly accessible, and is perfectly rigid. The valve arrangement, which has lately been improved and strengthened, is precisely the same as in the larger sizes of Packard pumps, and the pump is in every way adapted to heavy, continuous work. A vacuum within one-half inch of the barometric pressure is readily obtained.

Self-Locking Cleat.



Improved Vacuum Pump.

New Self-Locking Cleat.

Considering the almost unlimited number of cleats which have been introduced in electric light and power installations, it is evident that much thought, time and money have been expended in the effort to bring about perfection in this essential device. A late and interesting addition to this branch is the Nashold self-locking cleat, manufactured by the Nashold Cleat Company, 934 Monadnock Block, Chicago, which the illustration given herewith enables to be clearly understood.

There is a full half-inch of porcelain between the point of contact of wire and ceiling, thus bringing the device within the requirements of underwriters, whose endorsement it has received after severe and exhaustive tests. One of the features claimed for the cleat is that it retains no moisture. The base of the holding point forms a ridge at the apex of which the wire crosses, and any moisture that might be in the surrounding atmosphere would have no more chance to collect than is unavoidable with any other section of the line. In installing, all that is required is to push the wire through the opening, then pull it straight, and it is held as strongly as in a vise. It enters and emerges from its anchorage on exactly the same lines, so that its appearance is as though it was pulled through a straight hole.

Financial Intelligence.

THE ELECTRICAL STOCK MARKET

NEW YORK, Nov. 24, 1894.

ELECTRICAL STOCKS can only become speculatively active in response to active trade conditions. The failure of business interests to respond in a marked degree to the hopes based on election results have of a necessity kept the more conservative electrical stocks somewhat in the financial background this week, so far as any actual trading is concerned. Nevertheless the old favorites find a ready market and there is no difficulty in obtaining a quotation.

GENERAL ELECTRIC has been unuusually quiet, not a line of gossip has been circulated as likely to effect the trading in this security. It has not been marked with much strength. This is, however, entirely in sympathy with the general market, which, being left entirely to the professionals, has been directed on a bear tack as being along the line of least resistance. The logical trend of general Electric quotations is upwards, if it is to keep in accordance with the official statements, which are uniform in their announcements of growing prosperity. But the stock market tendency this week was downwards, and General Electric's course, while without significance, has not been an exqception.

WESTINHOUSE ELECTRIC.—Business continues to improve at a steady pace. The company is understood to have unfilled orders on hand amounting to $1,500,000. With the current orders this will give full employment to the new works. It is expected that the removal to the new plant will be completed by January 1; arrangements have been so completed that the task of removing the machinery will not interfere with the regularity of output, despite the fact that there are three months' orders on hand. The usual dividends on the preferred stock will be declared shortly. Officers of the company deny absolutely the rumor repeated in these columns last week that the dividend would be paid in script. The distribution will be, as usual, in cash, though Westinghouse scrip is not to be sneezed at. Some scrip issued at previous periods commands 98 in an open market.

THE BELL TELEPHONE stock authorized at the special stockholders' meeting on the 15th inst. will, according to Secretary of State Olin, of Massachusetts, be offered to shareholders at 190. The issue, as already herein related, is 5,000 shares; this lot is offered as an experiment under the regulations recently enacted by the Legislature, relative to the increase of the company's capital from $20,000,000 to $30,000,000. Should this sale be successful, from the company's standpoint, the other $25,000,000 new stock, which President Hudson says are necessary for the extension of the company's lines, will be issued in similar fashion. The "market" price of the new 5,000 share issue was fixed by Commissioner of Corporation Endicott, but it has not effected the Stock Exchange quotations to any extent. It is 196 asked. There is no likelihood, despite talk to the contrary, that the new issue will interfere with dividends at present rates. A Boston banker, prominently identified with company interests, but of his own wish nameless, says that "the public will see that the higher American Bell Telephone stock sells, the more certain it is that the 18 per cent. dividend rate will be maintained.

WESTERN UNION TELEGRAPH has kept the so-called industrial group company in a slight decline. The bears have directed some particular efforts against this security, basing their campaign on the reports of damage occasioned by the storms prevailing all during the month. Certainly the company suffers from this cause, not so much by the direat damage to property as through the loss of revenue through the compulsory interferenuce with operations. Then, too, the new constitutional amendment forbidding gambling in New York State will cut off the old, lucrative pool room business, and a good deal of harping is done on this string. President Eckert says, however, that earnings are improving, especially in the South, which indicates a general improvement in business.

AMERICAN DISTRICT TELEGRAPH directors adjourned their recent meeting till the latter part of next month, so no action is yet taken on the declaration of a dividend, but it is felt that the interruption of declaring a dividend is only temporary.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked
Chicago Edison Company	100	120	130
Cleveland General Electric	100	80	90
East River Electric Light Co.	100	—	50
Edison Electric Ill., New York	100	100½	101½
" " " Brooklyn	100	109	112
" " " Boston	100	125	128
" " " Philadelphia	100	120	125
Edison Ore Milling	100	13	15
Electric Construction & Supply Co., com.	15	7⅛	10
" " " " pref.	15	7½	10
Fort Wayne Electric	100	2	3
General Electric	100	34¼	35
General Electric, pref	100	67	70
Westinghouse Consolidated, com.	50	34⅛	35⅛
" " pref	50	51	52

BONDS.

Edison Electric Ill., New York	1,000	107¼	107¾
Edison Electric Light of Europe	190	75	85
General Electric Co. deb. 5's	1,000	90	91

TELEGRAPH AND TELEPHONE.

American Bell Telephone	100	194	196
American District Telegraph	100	40	45
American Telegraph & Cable	100	88	91
Central & South American Telegraph	100	102	105
Commercial Cables	100	125	145
Erie Telephone	100	52⅛	53
Gold & Stock Telegraph	100	103	105
Mexican Telegraph	100	180	190
New England Telephone	100	67	69
Postal Telegraph-Cable	100	50	55
Western Union Telegraph	100	87⅛	87⅜
Ex-div.			

THE FORT WAYNE ELECTRIC CORPORATION 6 per cent. debenture bonds had the third installment paid on them this week. These are the bonds for which the old Fort Wayne Electric Companys' stockholders subscribed for in the re-organization. No quotations as to these bonds come to light, as they are not yet traded in. It will be remembered that the bonds were offered at 90, payable 10 per cent. in cash by October 1, 40 per cent. in cash by October 31 and 50 per cent., on or before November 20 either in cash or in old Fort Wayne Electric Company stock at $5, or in both stock and cash.

THE STREET RAILWAY AND ILLUMINATING PROPERTIES trustees purchased and cancelled 586 shares of preferred stock with the $50,000 set aside last week for this purpose; the average price per share paid for this lot was $102.35, the first lot being bought in under 90. The present purchase makes a total of 17,693 shares retired to date.

THE TRACTION STOCK MARKET this week continued to respond to the demand for street railway issues in vogue now for some time, all good issues meeting with ready market. Philadelphia securities have fluctuated more than others by reason of the speculative interest attached to them, but the good earnings reported by other out of town roads has kept quotations up to recent records. What with the spread of knowledge of these stocks and the increased favor with which they are regarded by investors by reason of their possibilities for money making, there is an ever-growing disposition to add more of these securities to the few now dealt in on the New York Stock Exchange. The great interest taken in the Philadelphia stocks by many local operators will soon make it necessary to give a local opportunity for dealings in such stocks as Metropolitan Traction, Philadelphia Traction, etc., and already a concerted effort is being made to list these speculative favorites on the New York Stock Exchange. Boston advices supplement the above remarks by the statement that there is a good reason to believe that much of the recent buying of traction stocks there has been for New York account and this means that one or two of them, especially West End Street Railway common, will ultimately be listed here. New York operators know a good thing when they see it and they are not generally the kind to let it slip by.

BOSTON trading in electric traction stocks has this week been given over to transactions in West End Railway, whose annual report for the year ending Sept. 30, 1894, just published, shows a surplus after dividends of $98,356, a loss, as compared with 1892-93. The report, however, brought about good buying, and 60 is talked of for the common stock. President Little says that "there is cash enough on hand to cover the expense of finishing the electric equipment now under way and contemplated." It is expected that electric power will be inaugurated on the East Boston division by the middle of December.

ELECTRIC TRACTION STOCKS.

	Bid.	Asked
Union Ry. Co. (Huckleberry)	130	136
Brooklyn Traction pfd.	65	68
" " common	15	16
Long Island Traction	12¼	13
Rochester St. Ry	39⅞	40
Columbus St. Ry	45	50
Louisville St. Ry. pfd	87	88
" " " common	37	39
Cleveland Electric Ry.	45	47
Cleveland City Ry.	56	58
North Shore Traction	22⅛	—
New Orleans Traction	59½	—
Worcester Traction pfd	82	86
" " common	14½	16
Metropolitan Traction Philadelphia	107	108
Philadelphia Traction	102	102⅛
People's Traction	55	55⅛

BONDS.

	Bid	Asked
*Union Ry. 1st. mtge 6s	105	108
*Westchester Electric 1st. m. 5s	98	101
Rochester St. Ry. 1st. 5s	95	97
*Columbus St. Ry. 1st 5s	89	92
Columbus Crosstown 1st. 5s	95	97

*With accrued interest.

NEW INCORPORATIONS.

THE PAINESVILLE TELEPHONE COMPANY, capital stock $10,000, has been incorporated.

THE DEARBORN ELECTRIC COMPANY, Chicago, Ill., has been incorporated by T. C. Rafferty, Charles Messer and J. P. Rafferty, with a capital stock of $25,000.

THE MOUND CITY ELECTRIC LIGHT AND POWER COMPANY, Mound City, Ill., has been incorporated by A. J. Dougherty, E. G. Bruckman and S. E. Bruckman with a capital of $50,0000.

THE UNION TELEGRAPH AND TELEPHONE COMPANY, Pittsfield, Mass., capital stock $5,000, has been formed for the transmission of intelligence by electricity. S. N. Fuller, Michael Casey and R. A. Burget are interested.

THE CITIZENS' LIGHT AND POWER COMPANY, Sullivan, Ind., capital stock $15,000, has been incorporated to supply light, heat and power. Neah Crawford, Silver Chaney and Mary A. Crawford, Sullivan, Ind., are interested.

THE PHILADELPHIA AND LANSDALE RAILWAY COMPANY, Philadelphia, Pa., has been incorporated to construct, maintain and operate an electric railway. Robert A. Welsh, H. A. Mullen and John H. Moffit, Philadelphia, are interested.

THE UNION TELEGRAPH AND TELEPHONE COMPANY, Pittsfield, Mass., capital stock $5,000, has been incorporated for the transmission of intelligence by electricity. S. N. Fuller, Michael Casey and R. A. Burget are interested.

THE MOUNT CARROLL ELECTRIC LIGHT COMPANY, Mount Carroll, Ill., capital stock $12,800 has been incorporated to establish and operate an electric light and power plant. Owen P. Miles, Wm. Q. Sayers and Oscar F. McKenney are interested parties.

THE MONTPELIER ELECTRIC LIGHT COMPANY, Montpelier, Vt., capital stock $15,000, has been formed to supply electric light, heat and power. The promoters are John P. McGeath, John A. Remy, Hartford City, Ind., and Allen M. Hall, Kokomo, Ind.

CARTHAGE, WEBB CITY, JOPLIN AND GALENA ELECTRIC RAILWAY

COMPANY, St. Louis, Mo., capital stock $175,000, has been incorporated. John J. Taussig, David R. Powell, St. Louis, Mo., Charles C. Carroll, Springfield, Ill., are interested.

THE PHILADELPHIA AND LANDSDALE RAILWAY COMPANY, Philadelphia, Pa., capital stock $100,000, has been incorporated to construct, maintain and operate an electric railway. Robert A. Welsh, H. A. Mullen, John H. Moffit, Philadelphia, Pa., are the promoters.

THE S. K. C. SPECIALTY COMPANY, Pittsfield, Mass., capital stock $12,500, has been incorporated for the manufacture and sale of machines, apparatus, tools, electrical appliances and novelties. R. de W. Sampson, Wm. Gardner, John F. Kelly and C. C. Chesney are interested.

WILDER SLOSS ELECTRIC HOTEL CALL COMPANY, Chicago, Ill., capital stock $250,000, has been incorporated to manufacture, sell and deal in electrical devices and all articles pertaining to any electrical device. Louis Stein, Augustus Binswanger and E. R. Wilder are interested.

THE JASPER COUNTY ELECTRIC RAILWAY COMPANY, St. Louis, Mo., capital stock $50,000, has been incorporated by John W. Halliburton, Samuel Reynolds, Isaac Perkins and others, to construct an electric railway from Carthage to Cartersville, Webb City and Joplin, a distance of 15 miles.

THE NATIONAL ELECTRICAL REMINDER COMPANY, Chicago, Ill., capital stock $250,000, has been formed to manufacture and sell electrical devices, appliances, instruments, etc., and to buy and sell patent rights. Siegfried Rosenfield, Augustus Rosenfield and David C. Thoms are interested.

THE SHEDLOCK AUTOMATIC BRAKE COMPANY, Jersey City, N. J., capital stock $250,000, has been formed to manufacture and sell brakes for cars propelled by steam, cable, electric or horse power, etc. Alfred Shedlock, Jersey City; Wm. H. Foster, Elizabeth, and Anderson Price, Rutherford, N. J., are the organizers.

THE SECOND AVENUE TRACTION COMPANY, Pittsburgh, Pa., capital stock $10,000, has been formed to construct and operate motors and cables or other machinery for supplying motive power to passenger railways. G. T. Hamilton, Edgewood, Pa.; W. L. White, T. W. Hierker, Pittsburg; H. J. Stern, Avalon, and W. T. Ford, Allegheny, Pa.

NORTH AMERICAN INTERIOR TELEPHONE COMPANY, OF BALTIMORE CITY, Baltimore, Md., capital stock $60,000, has been incorporated to manufacture telephones, telephone appliances, electric switches and other electrical machinery. Fred. K. W. Schulz, J. Kemp Bartlett, Jr., Seneca P. Bromal, Charles C. Hughes and Thomas R. Brimmer are the promoters.

THE SECOND AVENUE TRACTION COMPANY, Pittsburg, Pa., capital stock $10,000, has been incorporated to construct and operate motors and cables or other machinery for supplying motive power to passenger railways. G. T. Hamilton, Edgewood, Pa.; W. I. White, T. W. Dierker, Pittsburg, H. J. Stern, Avalon, Pa., W. T. Ford, Allegheny, Pa., are interested.

THE INTERNATIONAL COPPER SMELTING COMPANY, Jersey City, N. J., capital stock $5,000, has been incorporated to smelt and refine copper ore and other metals in all branches by means of electric, chemical, fire, or other process. Geo. Lowther, Riverside; Ed. L. Smith, Francis M. Smith, Ansonia, Conn.; Thos. K. Egbert, Pattenberg, N. J.; Chas. H. Brush and Henry I. Uderitz, Brooklyn, N. Y., are the organizers.

Special Correspondence.

New York Notes.

Office of The Electrical World,
253 Broadway, New York, Nov. 24, 1894.

THE STATE RAILROAD COMMISSIONERS have granted permission to the Nassau Electric Railroad Company, of Brooklyn, to use the overhead trolley system in New York avenue, from Fulton street to Atlantic avenue.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION, under date of November 22, informs us that the eighteenth Convention of the Association will be held at Cleveland, Ohio, February 19, 20 and 21, 1895. Headquarters will be at the Hollenden Hotel, and the meetings at Army and Navy Hall.

THE INTERIOR TELEPHONE COMPANY, of New York City, is very much gratified with the results attending the sale of its telephones since its introduction to the public. The company claims that its combination is the only one which does not infringe any of the Bell patents.

MR. WILLARD M. MINER has resigned the general managership of the American Manufacturing and Engineering Company, in which company, however, he still retains an interest, and will devote most of his time hereafter to the Bi-metallic Electric Transmission Company, 80 Broadway, of which company he is vice-president. In addition Mr. Miner will do a general expert and consulting business.

SEALED PROPOSALS will be received by the Department of Charity and Corrections, Kings County, N. Y., until 12 m., Nov. 28th, at the office of the Secretary of the Board, 29 Elm place, Brooklyn, N. Y., for furnishing supplies for the use of the department, consisting, among other things, of electrical supplies. Schedules (ready for distribution), with full particulars, can be obtained at the above address. The commissioners reserve the right to reject any or all bids. A. Simis, Jr., is president and Bernard Lamb, secretary.

Western Notes.

Branch Office of The Electrical World,
936 Monadnock Building, Chicago,
November 24, 1894.

THE NASHOLD CLEAT COMPANY, of 934 Monadnock Block, is busy filling orders for its new cleat. This has met with an instantaneous success.

F. E. DONOHOE, Western manager for the American Electrical Works, has closed an order with President Yerkes, of the North Chicago Railway Company, for $118,000 worth of wire for use on the new electric lines to be equipped in the near future. This is claimed to be the largest wire order ever placed, and Mr. Donohoe is justly proud of his achievement.

THE WESTERN TELEPHONE CONSTRUCTION COMPANY reports business as brisk as ever. The Hartford City, Ind., exchange will be started during the week. They are replacing 50 'phones of another make at Shelbyville, Ill., and installing their new No. 1. The week's shipments include 130 instruments for the new exchange at Fostoria, O. The new Keelyn automatic switchboard will replace the Strowger now in use in the private exchange at the Johnson Company, Johnstown, Pa. President Keelyn has started on a trip to the Coast, to be gone some time on business.

Canadian Notes.

Ottawa, Nov. 20, 1894.

WINNIPEG.—It is said the capacity of the Northwest Electric Light Company will be doubled next season, and that the company will expend $40,000 in plant, extensions, etc.

MONTREAL.—Application has been made for a charter of incorporation by "The Stadacona Water & Light Company," at Montreal. Capital stock $40,000. The objects of the company are to build aqueducts and furnish water and light to towns and villages in the province.

AYLMER, QUE.—The town council has passed a by-law granting a twenty-year charter to the Hull Electric Railway Company for the operation of an electric railway between Hull and Aylmer and through the streets of the latter town. It is expected the road will be in operation by July next.

BROCKVILLE.—A. B. Wilgus, of Boston, representing a company of American capitalists, has made a proposition to the city council offering to build an electric street railway in Brockville. They ask for a twenty-year franchise, an acre of ground for buildings, exemption from taxation and permission to run the cars on Sunday.

THE ANNUAL MEETING of shareholders of the Montreal Electric Street Railway was held last week. The election of directors resulted as follows: L. J. Forget, James Ross, H. A. Everett, K. W. Blackwall, G. C. Cunningham. At a subsequent meeting Mr. Forget was made president, Mr. Ross vice-president and managing director, Mr. Cunningham manager. Mr. Ross takes Mr. Everett's place on the board as vice-president, and Mr. Cunningham's as managing director.

OTTAWA.—For a week past negotiations have been in progress for the establishment of a large factory in Ottawa for the production of porcelain ware, carbons, etc., connected with the electrical demands of the present day. The plans of the company comprise the erection of a building two stories having two kilns for burning the carbons, and several workshops suitable for the employment of from 50 to 100 skilled artisans at the start. The building will cost about $30,000 without machinery.

ST. JOHN, N. B.—The electric railway people made application to the mayor of the city requesting him to rescind the order which he issued on Tuesday forbidding the company to run their cars. The mayor refused to grant their request, contending that it would not be safe for the company to turn on the electric current until all the wires which had been knocked down by the storm were repaired. The company, on the other hand, contend that the road can now be operated with perfect safety and threaten to sue the city for damages for every day that the cars are stopped.

MONTREAL.—President Thibaudeau, of the Royal Electric Company, states that an arrangement had been made with the Stanley Electric Company, of Pittsfield, Mass., whereby they would supply the Royal Electric with all their patents and models in the future on which would be paid a royalty. In a few days the company would commence to build new workshops, and would immediately go ahead with its new arrangement. It is said there will likely be some changes at the Royal Electric Works, as some of the officials of the Stanley Company will have to come here, for a time at least.

MONTREAL.—The Recorder of this city has imposed a nominal fine on the Electric Street Railway Company for overcrowding their cars. One car licensed to carry 36 passengers was found with 50 passengers on board. The judge, in rendering judgment, said: "I understand that it is difficult to prevent overcrowding on the cars, owing to the persistency of the public in boarding them, but, so long as the city by-laws restrict the carrying capacity of the cars to a certain number, the company must obey the rules or suffer the consequences. If the company objects to the by-laws and finds it impossible to obey them, it must either get them repealed or pay for breaking them."

News of the Week.

Telegraph and Telephone.

CHICAGO, ILL.—The Chicago Telephone Company will erect a telephone exchange on 55th street.

SALISBURY, MD.—Active preparations are being made to reorganize a company to erect the Wicomico County telephone line, which will be worked in connection with the Salisbury Telephone Company.

WASHINGTON, D. C.—Sealed proposals will be opened on December 16, by the Depatrment of the Interior, Washington, D. C., for the construction of a telephone exchange system. W. H. Sims is acting secretary.

RAHWAY, N. J.—A new telephone company has been organized, with the following incorporators: Charles Oliver, H. B. Robinson, Wm. Howard, Wm. Chamberlain, Ferdinand Thompson and W. J. Lansley. The object of the company is to supply the local telephone service to Rahway at low prices.

Electric Light and Power.

MT. JEWETT, PA., is to have electric lights.

SAULT ST. MARIE, ONT.—Electric lighting station has been burned.

EAST PALESTINE, O.—The citizens are agitating the question of electric lights.

WELLSBORO, PA.—T. B. Field & Son, Wellsboro, Pa., want to purchase a 75-light dynamo.

ROGERS, ARK.—Address the Mayor concerning the purchase of an $8,000 electric light plant.

AUSTIN, MINN.—The Committee on Lights was authorized to contract for 20 additional arc lights.

BUNKER HILL, MO.—Address the Mayor concerning the establishment of a proposed electric light plant.

NYACK, N. Y.—The Nyack Reformed Church building will employ both electricity and gas for lighting.

MOUNTAIN LAKE PARK, MD.—Machinery will be wanted for electric light plant. Address J. C. Alderson.

PORTSMOUTH, VA.—The Portsmouth Street Railway Company asks permission of Council to extend its tracks.

RENOVO, PA.—The electric light plant of Renovo is to be enlarged by the erection of a new building 50x30 feet.

PLATTSBURG, MO.—It is stated that the citizens are agitating the question of electric lights. Address the Mayor.

WINNIPEG, MAN.—The Northwest Electric Light Company will double its capacity next summer, spending $40,000.

SPRINGFIELD, MASS.—The city officials favor an electric lighting plant at the almshouse and the Wayfarers' lodge.

WATERFORD, N. Y.—At a meeting of the Town Board it was decided to appropriate $1,150 for electric street lighting.

PALATKA, FLA.—E. E. Haskell is seeking from the Council a 25-year franchise to supply the city with electric lights.

BREMEN, IND.—Plans and specifications are being prepared for the erection of the electric light plant. Bids will soon be called for.

ELWOOD, IND.—One of the boilers at the electric light and power house exploded, demolishing the building and wrecking the street car barns.

SYRACUSE, N. Y.—It is the intention to have subways built in the spring, and the Council will probably order all the wires of the city under ground.

LEBANON, PA.—Samuel Bell's Sons have secured the contract for the erection of the new boiler house at the Edison Illuminating Company's works and will begin the work immediately.

HOOSAC FALLS, N. Y.—Charles B. Story, lessee of the park and lake on the premises of Hon. S. D. Locke, has made many improvements on the grounds. The park will be lighted by electricity.

QUINCY, MASS.—At a meeting of the Quincy City Council, an order was passed authorizing the Mayor to petition the legislature for authority to establish a municipal electric lighting or gas plant.

FLEMINGTON, N. J., has plans for electric light under discussions and a committee consisting of Messrs. Alexander B. Allen, John F. Schenck and F. R. Williamson will visit Newton to examine the plant there.

EDWARDSVILLE, PA.—The borough attorney instructed the members of the Council to investigate as to the number of lights and their cost and let the people decide at the election to be held in February next.

ALLEGHENY, PA.—At special meeting the Common Council will in all probability appoint a committee of conference on the electric light contract. It is not expected that the conference committee will accomplish anything.

LONG ISLAND CITY, N. Y.—The aldermen held a special meeting to pass upon the specifications and form of contract with which those submitting proposals for furnishing electric, gas or other lights must comply, which were adopted.

ELM GROVE, W. VA.—Efforts are being made to form a company to construct water works, together with an electric light plant at Elm Grove and seem likely to be crowned with success. The city water board can probably give information.

SUMMIT, N. J.—The Township Committee has submitted propositions under which an electric light franchise will be granted and all bids are to be given in at the next meeting. The committee will exact a bond and favor an underground system.

SHENANDOAH, PA.—A meeting of citizens of the town will be held to take action towards organizing an independent electric light company. Several citizens are now negotiating to secure private plants. Max Schmidt, the dry goods dealer, is one of those interested.

PHILADELPHIA, PA.—The Electrical Committee of Common Council met to consider the Edison Electric Light ordinance, granting certain privileges to that company in the way of occupying the city streets with underground conduits. The bill was referred back to the Common Council.

MILLEVILLE, N. J.—The Common Council of Millville is fighting against the efforts of the Millville Electric Company to raise the rates for lighting the city. The Council has decided not to accept the proposition and the Lighting Committee was instructed to advertise for proposals.

GALESVILLE, WIS.—The village board has granted a 15-year franchise to D. M. Benton & Company for electric lighting purposes. This was done because Benton refused to extend his plant unless some protection was given him. He has two machines and will run about 800 lights.

NEW YORK, N. Y.—The plans for the proposed New York theater, that Messrs. Canary & Lederer propose erecting at the northwest corner of Seventh avenue and Forty-second streets, have just been completed by John D. Allen, architect, of Philadelphia. The illumination throughout will be by electricity.

ST. JOSEPH, MO.—An ordinance granting to Houston Wyeth the right to construct and operate an electric light and power plant in this city was introduced in the Council. If the franchise is granted the plant will be operated in connection with the St. Joseph Artesian Ice Company, where the same machinery can be used for both purposes.

CUTHBERT, GA.—M. F. Sullivan, of Mable & Sullivan, Atlanta, is making surveys for the proposed works and elctric light plant. Bids for the contract work will be asked for when specifications are completed. The city has issued $50,000 in bonds, and the $40,000 or $45,000 necessary to construct the plant will probably be sold at private sale this month.

MIDDLETOWN, O.—The official returns show that the Middletown Electric Light & Power Company has been voted a franchise to establish a plant, and it has been awarded the contract for lighting the city for the next ten years. Work on the new plant will be commenced at once, and it is promised that the new light will be in operation by Christmas day.

NEW HAVEN, CONN.—The committee appointed by the Selectmen to go to Hartford and present a petition to the Legislature for a special appropriation of $40,000 to provide some means of transit to the top of East Rock Park, are in favor of an elevator, and strongly oppose Mayor Sargent's plan to grant permission to the electric railroads to build a line to the top of the rock.

MILWAUKEE, WIS.—The Milwaukee Arc Light Company's plant has been sold to four of its directors. It is said that the amount they paid to the remaining stockholders was $86,500, but this does not represent the capital stock. The company was originally capitalized at $150,000, but an inventory made not long since put a valuation of $136,500 at a close estimate.

OWASSO, MICH.—Sealed proposals are wanted for lighting the streets and the city buildings of the city of Owasso for the term of one and three years from and after April 1, 1895, at any time previous to the hour of 4 p. m., of December 1, on the following basis: Sixty or more 2,000-cp arc lamps; also 60 or more 1,200-cp arc lamps; and 16 and 32-cp incandescent lights for the city. H. Frieseke is chairman.

MILWAUKEE, WIS.—The Board of Public Works has decided to send a communication to the Common Council recommending immediate action in the matter of providing lighting apparatus for the city hall. This is a big item of expense, requiring about $50,000. The wiring will cost about $18,000, and the dynamos, engines, etc., about $32,000 more. The board will ask that it be given authority to advertise for bids for the work.

KALAMAZOO, MICH.—A special election was held November 6, at which two propositions were submitted to the voters. One, authorizing the City Council to construct an electric lighting plant, was carried by yeas 1,878 to nays 1,397. The other proposition was to authorize the city council to borrow $40,000, to be used in constructing such plant, or for the purpose of lighting the city with electric lights or otherwise, through a contract, and this proposition also carried, yeas, 1,868, nays, 1,419. We are informed by the city clerk that he is unable as yet to give any information as to the probable final action, on either proposition, that will be taken by the city council.

THE ELECTRIC RAILWAY.

CATLETTSBURG, KY.—Work is to be at once commenced on the electric railroad.

VANCOUVER, B. C.—The electric street railway and lighting system at this place has been sold to an English company for $350,000.

SAGINAW, MICH.—The Saginaw street car line has been sold to the Union Street Railway Company electric line and will also be equipped with electricity.

TONAWANDA, N. Y.—A plan is said to be on foot to connect Lake Erie with Lake Ontario by an electric road by way of Tonawanda, Lewiston and Youngstown.

NEW ORLEANS, LA.—The stockholders of the Orleans Railroad Company have decided to equip the road with electricity and work will soon be commenced.

PORT JERVIS, N. Y.—Port Jervis will have a trolley road. The Suburban Street Railway Company has accepted the charter granted by the Board of Trustees.

CHICAGO, ILL.—The certificate of the North Side Electric Railway Company, proposing to increase the stock to $1,000,000, has been filed. A. B. Lewis is secretary.

BRISTOL, CONN.—Mr. McKenzie, of Southington, has been busy for a number of days on the survey for a new route for the tramway from Bristol to Plainville.

BALTIMORE, MD.—The Baltimore & Curtis Bay Railway, which is part of the Baltimore Traction Company's system, will be extended a distance of about one and a half miles.

WATERLOO, N. Y.—The work of building the Geneva and Waterloo electric railway is rapidly being accomplished. It is now thought that cars will be running on December 1.

BENNINGTON, VT.—The Governor has approved the bills incorperating the Bennington & Woodford Electric Railroad Company and the Bennington & Woodford Improvement Company.

NORRISTOWN, PA.—The Norristown & Perkiomen Electric Railway Company, the line of which runs from Upper Providence to Worcester, has been incorporated, with a capital of $150,000.

CHESTER, PA.—It is said that next summer will see the extension of the trolley system so that Rutledge, Morton, Folsom and Clifton Heights will be brought in close union with this city.

NEW ORLEANS, LA.—The Orleans Railway Company has decided to adopt electricity as a motive power. The estimated cost of the change is $210,000. P. Cougot is president of the company.

TOWER CITY, PA.—The right of way has been granted for the construction of an electric railway through the Williams Valley, commencing at Tower City and extending through Williamstown and Lykens.

BRAZIL, IND.—An electric line is to be built to connect Brazil and Terre Haute. Max Joseph and R. J. Smith are said to be incorporators of a company for this purpose, of which the capital stock is $15,000.

WARREN, O.—Three companies are seeking to get the franchise for an electric railroad from Niles to Girard and the county commissioners will consider the applications the first Wednesday in December.

SENECA FALLS, N. Y.—A project is on foot at Seneca Falls to extend the electric road from its present terminus near Partridge block to Cayuga. Mr. Craig, a prime mover, is interested in Cayuga Lake Park.

HOBOKEN, N. J.—The Jersey City, Hoboken & Rutherford Electric Railway Company has presented its petition to the Mayor and Council of the city of Hoboken, asking a location for the tracks of its street railway.

MECHANICVILLE, N. Y.—Messrs. Powers, of Lansingburgh, have been granted a franchise by the Board of Trustees of Mechanicville, for the construction of an electric railway from Mechanicville to Stillwater.

HINGHAM, MASS.—The hearing given by the Hingham select men on the petition of the Hingham Street Railway Company for a franchise was attended by 600 citizens. The selectmen took the matter under consideration.

PEEKSKILL, N. Y.—A franchise was granted November 20 to the Peekskill, State Camp and Mohegan Railway Company for an electric road. Mr. Edward B. Gallagher, 253 Broadway, New York, is the engineer of the company.

LAFAYETTE, IND.—Mr. E. B. Gunn, recently superintendent of overhead and underground work of the People's Traction Company, Philadelphia, has been appointed general manager of the Lafayette Street Railway Company.

CORNING, N. Y.—The following directors of the Citizens' Electric Railway Company have been elected: Arthur A. Houghton, B. W. Wellington, Col. John Magee and Frank D. Kingsbury. It is now thought the railway will be built.

EAST STROUDSBURG, PA.—East Stroudsburg's Council does not intend to pass an ordinance giving the Delaware Valley Electric Railway right-of-way through the streets without giving the various sections thorough consideration.

NORTHAMPTON, MASS.—The directors of the Northampton Street Railway Company voted to build the proposed street car line to Easthampton through the meadows. It is understood that the work will be commenced in the spring.

NASHUA, N. H.—At a meeting of the Board of Aldermen a petition was presented by the Nashua Street Railway Company asking the right to use electricity as a motive power, and to erect poles in the streets for the necessary wires.

WARREN, O.—A movement has been inaugurated looking to the connection of Youngstown and Warren by an electric railway, and an application has been made to the commissioners for a franchise from Youngstown to Niles by way of Girard.

BROOKLYN, N. Y.—A rumor has gained credence that the Prospect Park & Coney Island Railway, running from Ninth avenue and Twentieth streets and from Thirtieth street and Fifth avenue to Coney Island, will change its system to the trolley

ATLANTA, GA.—The City Council has extended until February 5, 1895, the franchise granting the Lithia Springs Electric Railway Company authority to build its lines into the city. B. F. Curtis is vice-president and general manager of the company.

OSWEGO, N. Y.—The Oswego Street Railway Company has made applicaton to the Common Council of the City of Oswego for permission to extend its line as now constructed and operated, in and upon certain streets of the city. Fred. D. Wheeler is city clerk.

TUNKHANNOCK, PA.—Lake Winola people are speculating upon the chances of an electric line from Coton to Tunkhannock, via the lake. They would have it to take in Newton Center and the other little hamlets down that way, and claim the route is feasible.

SALINA, KAS.—The bonus given L. M. Erb, of Leavenworth, for the construction of an electric street railway in this city has at last been fully secured by the committee. Mr. Erb pronounced everything all right, and will start work as soon as the franchise is granted.

KANSAS CITY, MO.—The motive power of the Broadway Line will be changed to electricity. The Metropolitan Company will ask for franchises as soon as the property owners have given their consent. Electricity will be furnished from the Metropolitan power house.

ANNAPOLIS, MD.—The directors of the Annapolis and Bay Ridge Electric Railway held a meeting to consider propositions of surveying the route of the proposed road. Several propositions were submitted by contractors to build the road. Mr. C. Musgrove presided at the meeting.

ALBANY, N. Y.—A project is on foot to unite Albany and Castleton with an electric railway for local trade. The proposed railway will go through Greenbush and down the river road. A preliminary meeting will be held. Some of the friends of the scheme favor an extension to Troy.

CLEVELAND, O.—F. A. Sieberling and an Akron syndicate have been granted a franchise by the County Commissioners to build and operate an electric railway along the improved Bedford road. The franchise is for 25 years, and in return for the grant the county will receive an annual payment of $300.

CORNING, N. Y.—The Citizens' Electric Street Railway Company, of Corning, has been reorganized with a board of directors as follows: B. W. Wellington, John Magee, and A. A. Houghton, all of that city. It is the intention of this new board to push the street railway project in that city as rapidly as possible.

OSWEGO, N. Y.—Some of the property owners living on the proposed lines of the street railway extensions object to the road going into their streets. The Street Railroad Company expects to be able to get the necessary consents to insure them the right-of-way, and believe the Council will grant them the franchise petitioned for.

CARTHAGE, MO.—The Jasper County Electric Railway Company has been incorporated with a capital stock of $50,000. John W. Halliburton, Samuel Reynolds, Isaac Perkins and others are interested. The object is to construct an electric railway from Carthage to Cartersville, Webb City and Joplin, a distance of 15 miles.

SAGINAW, MICH.—The Saginaw Consolidated Street Railway Company, which was organized some time ago with a capital of $150,000, has consolidated with the Riverside Park Railway. The plant, franchise and rights of the City of Saginaw line, one of the oldest in the State, have passed into the hands of the consolidated company.

SAGINAW, MICH.—The old horse car lines of the city, known as the City of Saginaw Railroad, at the head of which was ex-Governor Jerome, were sold to the Union Street Railway Company electric line, and will be equipped with electricity. All the street car lines of the city will now be under one arrangement, with Detroit men at the head.

OTTAWA, CANADA.—It is said Messrs. Joseph Tait and John Flett, of Toronto; L. C. Raymond, Welland, and others, are seeking incorporation as the Niagara River Tramway Company, to build and operate a cable tramway over the Niagara river. The headquarters of the company is to be at Niagara Falls, and the capital stock is placed at $40,000.

McKEESPORT, PA.—The Second Avenue Traction Company is the syndicate formed by the consolidation of the Reilly-Burns-Callery electric lines, running from Coraopolis to Braddock. This syndicate has, it is understood, purchased the Homestead Electric Street Railway Company's line on the west side of the Monongahela River, and will extend it to McKeesport, crossing to the east side of Glenwood.

NEWPORT, L. I., N. Y.—The project of establishing electric railway communications across Long Island, making Northport, on the north side, and Amityville, on the south side, terminal points, is receiving further attention, and it is not unlikely that the enterprise will at an early date receive a favorable impetus. The construction of a large and complete electric light plant at Northport is contemplated.

NORWAY, ME.—A new electric road, soon to be constructed, will be the Norway & Paris Street Railway. It will extend from South Norway, Paris, to Norway, a distance of two miles. The capital stock is $25,000, and the road is to be commenced in the spring. The directors are George L. Beal, Norway; Freeland Howe, Norway; John F. Hill, Augusta; H. L. Shepherd, Rockport; Geo. E. Macomber, Augusta.

WESTPORT, CONN.—It is said that Frances W. Marsh, of Bridgeport, Chas. Fable, F. D. Ruland, M. D., W. E. Osborne and Chas. Harris of Westport, have given notice that they will petition the coming legislature to incorporate them as the Westport & Southport Trammay Company, to build a trolley line from Lyons Plains in Weston to Westport, Cedar Point and Saugatuck, terminating at the New Haven railroad depot.

SOUTH BOUND BROOK, N. J.—The New York & Philadelphia Traction Company has asked the Board of Street Commissioners of South Bound Brook, Somerset County, for permission to construct, operate and maintain a street railroad, with one or more tracks and necessary turnouts, to be operated by electricity or other motive power except steam, and to erect conduits and wires, power plant and necessary poles, in certain streets of the city.

ELMIRA, N. Y.—It is said a project is on foot to connect Elmira and Waverly with an electric line, the tracks to follow the river road. The projectors of the enterprise are said to be stockholders of the Waverly, Sayre & Athens line. They believe Elmira would be an important terminus for their road, and by next spring it is rumored that if the right-of-way can be secured and contracts entered into with the E. & H. Co., whose lines they will tap at Maple avenue, actual work will be begun.

WASHINGTON, D. C.—Bids have been invited for building 16 miles of double track electric railroad from Washington to Laurel, Md., for the Washington & Baltimore Boulevard Company. The bids are to be opened the first week in December at the office of the president, David M. Newbold, of Baltimore. The specifications provide that the road shall be laid with 80-pound steel rails, and shall be so ballasted and constructed as to permit electric trains to attain a speed of 60 miles an hour. Three steel bridges, one of 100 feet and two of 50 feet, are also included in the specifications.

Personal Notes.

THE ANCHOR ELECTRIC COMPANY, of Boston, the newly organized electrical supply establishment of that city, and succeeding the Brown Electric Company and the supply business of the Hawks Electric Company and the Iona Manufacturing Company, possesses an executive staff which should certainly secure for it a strong business foothold and successful future. Mr. H. C. Hawks, its president, was born in Deerfield, Mass., in 1862. His early education was obtained in the public schools of that town, and in the year 1883 he entered the Worcester (Mass.) Polytechnic Institute, from which he graduated S. B. in civil engineering in the class of 1886. In the same year he commenced his business career in the engineering department of the Chicago, Burlington & Quincy Railroad at Chicago. In the spring of 1887 he became identified with the engineering department of the Atchison, Topeka & Santa Fe Road, and in the fall of that year associated himself with the Marr Construction Company of Pittsburg, a corporation occupying a prominent position in the field of electrical construction. This was the commencement of the electrical career of Mr. Hawks. Until the spring of 1889 he was engaged in superintending important electrical installations for this company in the west and south. In the spring of 1889 he became connected with the Boston office of this company, with which he was identified until it was absorbed by the North American Construction Company, of which he was made New England manager. He continued in this capacity until the early part of 1892, when, upon the company deciding to give up business, he purchased its New England business and conduc-

H. C. HAWKS.

NORMAN MARSHALL

P. M. REYNOLDS.

ed the same on his personal account for about a year. In 1893 he organized the Hawks Electric Company, of which he became treasurer and general manager, securing for it liberal and profitable business recognition in the form of construction work and electrical supplies. He remained with this company until the formation of the Anchor Electric Company. In the line of electrical construction Mr. Hawks has superintended the installation of about 75 lighting and power plants in New England alone, to say nothing of others distributed throughout the country and all of which have earned for him an enviable reputation. It may be said of him that he is thorough in everything that he does and careful and painstaking almost to the extreme, qualities which have won success for him in the past and which will unquestionably tell greatly to the benefit of the Anchor Electric Company. Mr. Norman Marshall, vice-president and secretary, was born in Hampstead, N. H., in 1864. In 1870 his parents removed to Howard, Mass. a small country village, and until he was 16 years of age his life was divided between the country school and the farm. His first business experience was in the office of an architect and civil engineer, a profession for which he had manifested a preference. He finally entered the Worcester (Mass.) Polytechnic Institute, from which he graduated S. B. civil engineer in 1886. Like Mr. Hawks, he also became identified at once with the Marr Construction Company, and during his connection with it assisted in the construction of some of the first Edison central stations built, becoming ultimately a superintendent of the company and having charge of several notable plants in the west and south, those worthy of special mention being located at Altoona, Pa., Dayton, O., Birmingham, Ala., and Fort Worth, Gainesville, Marshall and Houston, Texas. Returning from Texas in 1889 Mr. Marshall was assigned to the Boston office of the Marr Construction Company, and when it was merged into the North American Construction Company he decided to enter into the manufacture of electrical specialties, and located in Philadelphia, where he remained until the spring of 1892, when he returned to Boston and formed the Iona Manufacturing Company, the success of which is so well known as to require no special mention, and the same energy which obtained this success, will, without the saying, be exerted to push forward the Anchor Electric Company. Mr. P. M. Reynolds, treasurer, was born at Nahant, Mass., in 1868. He was given an excellent common school education, after which he entered at Harvard and from which he was graduated in 1889. He was attracted at once to the business possibilities in the electrical industry and entered the factory of the Thomson-Houston Company, remaining there for six months, familiarizing himself with the manufacture of electrical apparatus, after which he connected himself with the mining and motor department of the company, performing expert work for about a year in mines all the way from Pennsylvania to Utah, returning finally to the Boston office in the capacity of salesman. In the fall of 1893 Mr. Reynolds resigned the position to become treasurer of the Brown Electric Company, a position he was in every respect competent to fill, and the experience gained with this company, added to his general electrical knowledge, should eminently fit him for the position he occupies with he Anchor Electric Company.

Trade and Industrial Notes.

THE LE ROY HYDRAULIC ELECTRIC COMPANY, Le Roy, N. Y., is constructing a building at the plant north of the village, in which will be placed a 75-hp boiler and engine.

THE MASCHINENFABRIK OERLIKON, Oerlikon bei Zurich, has obtained at the international exhibitions of Lyons and Antwerp of this year the highest award, the "Grand Prix," for eminent work in the line of electrical industry.

MR. ADDISON G. WATERHOUSE, the well known inventor of the Waterhouse Arc Lamp and Arc System, who has recently returned from Europe, is now connected with the Mather Electric Company, at their works at Manchester, Conn.

THE BUNCH & YATES COMPANY, Memphis, Tenn., recently closed contracts for four saw mill plants. Owing to the reduction of insurance that follows the installation of an electric lighting plant, their use is extending in saw-mills of the South, the cost of operation being practically nothing.

THE OLIN GAS ENGINE COMPANY, Perry and Chicago streets, Buffalo, N. Y., in a recent catalogue describes its new pattern of gas engine especially adapted for electric light plants. The pamphlet contains considerable information relating to gas engine electric plants and will prove interesting reading to those interested.

THE SHEDLOCK AUTOMATIC BRAKE COMPANY has been incorporated, and will make Jersey City, N. J., its place of business. The capital stock is $250,000. The company will manufacture brakes for steam, electric and cable cars. The incorporators are Alfred Shedlock, of Jersey City, Wm. H. Forster of Elizabeth, and others.

THE ELECTRIC ENGINEERING & SUPPLY COMPANY, Syracuse, N. Y., has opened an office in the Electrical Exchange Building, at 136 Liberty street, Room 315, with F. M. Hawkins in charge. It has also opened a store room at 132 Washington street where will be kept a sufficient line of stock on hand to meet the wants of New York customers.

J. H. BUNNELL & COMPANY, 76 Cortlandt street, New York, have issued a new edition of their familar catalogue, the present one containing 225 pages and nearly 750 illustrations. As every one knows "Bunnell's catalogue" it would be superfluous to describe it, and we will merely say that it is thoroughly up to date, with considerable additions in various departments, particularly electric lighting.

THE SPERRY ELECTRIC RAILWAY COMPANY, Cleveland, O., in a handsome 38-page catalogue describe and illustrate the Sperry Street Railway system, including the electric brake recently introduced to the electrical public through a paper read before the American Institute of Electrical Engineers The numerous half-tone illustrations throughout the pamphlet enable the various details of the system to be easily understood, while the text brings out very full, the points of superiority claimed for it.

THE D. M. STEWARD MANUFACTURING COMPANY, Chattanooga, Tenn., makers of the well known lava electric insulators, reports a gratifying revival in its business and its orders are more frequent and much larger than some time ago. Its insulators are equally good for interior or exterior work, overhead, underground or under water, and it is claimed will stand a greater heat than anything else known. Its insulators have been extensively used by leading electrical manufacturing companies.

THE ELECTRIC APPLIANCE COMPANY, Chicago, Ill., reports that the excessively heavy demand for "O. K." weather proof wire during the past few months has taxed its ability to keep up its stock, and as each car load is received it seems to melt away before it can be placed in position in the stock room. New arrangements have just been completed to obviate any delay in filling orders, and the company therefore assures its customers that in a few weeks it will be in a position to fill more promptly orders from its Chicago stock.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., has just completed for the Baldwin Locomotive Works, of Philadelphia, Pa., steel roof trusses for the addition to their wheel shop. The same company will also furnish the new power station for the United Electric Light & Power Company, on East 28th street, New York city. The power house is 100 feet wide and 200 feet long; the engine room is 100 feet wide and 80 feet long, and the boiler room is 56 feet wide and 100 feet long. The coal pockets in the boiler room have a capacity of 3,000 tons.

MR. E. H. JOHNSON, of the Interior Conduit & Insulation Company, 44 Broad street, New York, very generously disclaims what he considers undue credit given him in the article in our columns last week descriptive of a new service end cut-out. In a letter to us he states: "In your illustration and description of Mr. Van Vleck's 'Service End Cut-Out' there appears too much Johnson, and too little Van Vleck. I am not the father of that baby; my only relation to it in fact is a sort of cousinship in that Mr. Van Vleck has married his invention to the Johnson Vise Lock Switch. Kindly correct the injustice done to a worthy parent of a worthy child."

THE MATHER ELECTRIC COMPANY, of Manchester, Conn., have just concluded arrangements with Manning, Maxwell and Moore, of New York, and the Niles Tool Works, of Hamilton, Ohio, for a large amount of new machine tools, which will be installed in the Manchester plant at once, and which are especially adapted for the building of large direct connected and belted generators which the Mather Company are now making quite a specialty of. The plant at Manchester has been running over-time with full force for the last two months and the company now has orders on hand to keep its entire plant busy from four to five months.

EDWARD F. AUSTIN, 95 Fifth avenue, Pittsburg, Pa., who before the assignment of the Altoona Manufacturing Company, was its efficient sales agent of the Pittsburg district, has taken charge of the Pittsburg office of the Phœnix Iron Works Company, of Meadville, Pa., manufacturers of the well known Dick & Church engines, boilers, feed water heaters, etc. Mr. Austin reports the sale of a 15x18 engine to Jones & Laughlin, and three 100-hp. boilers for the Schenley Park Casino; these boilers are particularly designed for safety, etc., and are of special make all through. He also reports several smaller sales and states that inquiry is increasing from all localities and that he looks forward to an increase of trade in the boiler and engine business.

H. D. BAYNE & COMPANY, Mutual Life Building, New York, whose organization was reported in our issue of November 17th last, have just received the appointment from the Campbell & Zell Company, of Baltimore, Md., as its managers for the States of New York and New Jersey. This will open up to the firm a large field for their activity in the selling of the Zell Patent Safety Water Tube Boiler, which has earned for itself an enviable record for efficiency and economy as a steam producer, as well as for absolute safety, simplicity of construction and superiority of workmanship. The firm will be glad to receive inquiries from intending purchasers of boiler plants, and have at their disposal an interesting catalogue, and some other useful literature to steam users.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., in order to properly take care of its increased transformer business, is making an addition to its factory. The transformer department has been running three nights in a week, in an endeavor to keep ahead of orders. With increased floor space the facilities for manufacturing transformers will be greatly increased, and the company then will be able to take care of promptly, and ship from stock, any reasonable sized order they are favored with. Among some very large orders, recently booked, was one from the La Roche Electric Works, for its new plant at Atchison, Kansas. An office was opened Nov. 12th, at 15 Federal street, in Boston, with R. O. Hood, late of the General Electric Company's meter and transformer department in charge.

ELMER G. WILLYOUNG & COMPANY, through Mr. Elmer G. Willyoung, who has just returned from a two months' visit to England, have consummated arrangements for acting as the sole American agent for Messrs. Nalder Bros. & Company, London, the largest manufacturers of electrical instruments of precision in the world. He will also act as the agent for James White, Glasgow, Scotland, maker of Sir Wm. Thomson's balances and electrostatic measuring instruments, and for L. Oertling, London, analytical and assay balances. Arrangements have also been made with other foreign firms to import apparatus at most advantageous rates, and to have any instruments which may be damaged in the transit, repaired by experienced workmen, under the personal supervision of Mr. Willyoung. It is the intention of Nalder Bros. & Company and James White to make as rapidly as possible, such modifications in the design of their instruments, as shall better adapt them to the needs of American users, and new instruments, especially fitted for American practice, will be designed and brought out as rapidly as possible. Mr. Clayton W. Pike, formerly of Queen & Company, will be associated with Mr. Willyoung. Mr. Pike was in charge of all the Worlds' Fair exhibits of Queen & Company, and has a very extensive acquaintance among the colleges and technical schools, having personally visited nearly all of them, during the year previous to the World's Fair, for the purpose of obtaining a better acquaintance with their requirements.

Business Notices

BATTERY CUT-OUT, CHEAP.—Sensitive, reliable, never requires attention Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren street, Syracuse, N. Y.

TO WHOM IT MAY CONCERN.—Take notice that the co-partnership existing under the firm name of Bradley & Combs, doing business at Rochester, N. Y., has been mutually dissolved,

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED NOVEMBER 20, 1894.

(In charge of Wm. A. Rosenbaum, 177 Times Building, New York.)

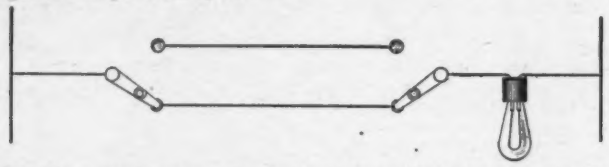
529,354. CONTACT DEVICE FOR OVERHEAD ELECTRIC RAILWAYS; J. L. Blackwell, New York, N. Y. Application filed September 15, 1888. The combination of a rod having a hollow end, a piston carrying a contact piece and forced by spring pressure against the supply wire, and a cord attached to the piston leading to a fixed point of the vehicle.

529,373. ELECTROMAGNETIC APPARATUS; S. D. Field, Stockbridge, Mass. Application filed July 24, 1894. A polarized induction coil having both poles of the inducting medium inclosed within the primary and placed outside of the secondary circuit.

529,385. ELECTRIC FAN MOTOR; F. X. Hofbauer, Newark, N. J. Application filed August 1, 1894. This comprises a field magnet consisting of a permanent magnet having upwardly extending poles and constituting an extension of the standard or support.

529,398. AUDIBLE SYNCHRONISM INDICATOR; R. D. Mershon, Pittsburg, Pa. Application filed April 27, 1894. This comprises a polarized diaphragm, a magnetic core presenting two poles thereto and two coils connected with the terminals of the machines to be synchronized, each of the coils producing one of the actuating poles.

529,399. AUDIBLE SYNCHRONISM INDICATOR; R. D. Mershon, Pittsburg, Pa. Application filed April 27, 1894. This comprises a coil in series with the two machines to be synchronized and a vibrating body actuated by the magnetic field produced by the coil.



No. 529,532.—Switching Apparatus for Incandescent Electric Lamps.

529,406. UNDERGROUND ELECTRIC RAILWAY. H. B. Nichols and F. H. Lincoln, Philadelphia, Pa. Application filed June 13, 1894. This comprises a road bed, track, rails and frames, the latter reversibly arranged to constitute a slotted contracted chamber communicating with an enlarged lower chamber, racks supporting supply or feeder wires and an electric conductor in the lower chamber supported by insulated cross guys to the structure out of alignment with the slot of the contracted chamber.

529,411. MANUFACTURE OF ELECTRIC CONDUCTORS. J. Robinson, Philadelphia, Pa. Application filed February 16, 1894. This comprises a carding engine with a wiper, a jacketed tank provided with a revoluble roll, a nozzle a rotatable whirler, a tank for containing insulating material and a winding reel.

529,412. INSULATED ELECTRIC CONDUCTOR; J. Robinson, Philadelphia, Pa. Application filed February 17, 1894. A wire provided with an insulating coating having a smooth surfaced covering of cotton thereon a binder of cords in regular sequence wound around the same, and a coating of insulating material permeating the body of the covered wire.

529,413. MANUFACTURE OF ELECTRIC CONDUCTORS; J. Robinson, Philadelphia, Pa. Application filed March 6, 1894. This consists in rotating and drawing a wire through a bath of insulating material, feeding, and while the wire is still moist applying and compacting cotton under tension, to form a binder therefor.

529,421. MULTIPLE SWITCHBOARD SYSTEM; C. E. Scribner, Chicago, Ill. Application filed May 1, 1890. The combination with a pair of plugs and cords, of a cord switch consisting of a frame having a socket for one of the plugs, a pair of springs in a branch from the cords through a telephone and a battery to ground, and a plunger mounted on a pivoted guide provided with an arm and contact springs operated by forcing down the plunger.

529,429. ELECTRIC INCANDESCENT LAMP; E. Thompson, Swampscott, and E. W. Rice, Jr., Lynn, Mass. Application filed February 8, 1892. The combination with a plurality of multiphase circuits, of a plurality of incandescent lamp filaments having separate connections to the circuits and to a common return, a reactive coil in the return, and a circuit controlling devices for all of the connections.

529,433. ELECTRICAL MEASURING INSTRUMENT FOR SWITCHBOARDS; J. Van Vleck, New York, N. Y. Application filed April 14, 1894. This comprises an inclosing case provided with an external periphery of less width than the sides of the case, a scale on the periphery and a pointer or index moving over the scale.

529,434. ELECTRICAL MEASURING INSTRUMENT; E. Weston, Newark, N. J. Application filed October 3, 1892. This comprising a vibrating lever, a coil supported on one arm thereof, a means of equilibrating the coil and a fixed coil disposed in a plane parallel to that of the movable coil when the movable coil is in a normal position and a spring opposing the vibratory movement of the lever.

529,435. ELECTRICAL MEASURING INSTRUMENT; E. Weston, Newark, N. J. Application filed June 21, 1894. A case formed of two separable parts, one part consisting of a side plate and flange, and the other of a side plate and flanges in combination with a rack secured on the exterior of the flange.

529,437. ARMATURE CORE; J. J. Wood, Fort Wayne, Ind. Application filed August 21, 1894. A sheet iron blank for an armature core, consisting of a segment of the core having on its inner side overhanging hooks for embracing the fastening bolts.

529,451. COMBINATION GAS AND ELECTRIC LIGHT FIXTURE; G. A. Loeben, Philadelphia, Pa. Application filed June 7, 1894. This comprises a tapered key, and arranged to be secured to the upper portion of the joint by a clamping screw, and provided with vertical and transverse passages, and having an externally threaded opening near its middle.

529,461. METHOD OF AND MEANS FOR SYNCHRONIZING ALTERNATING CURRENT MOTORS AND GENERATORS; H. N. Potter, Allegheny, Pa. Application filed May 3, 1894. This comprises a diaphragm, a magnetic core presenting a single motor-pole thereto, and two coils connecting to the terminals of the machines to be synchronized, the coils being so wound on the cores as to produce a resultant effect at the motor pole.

529,465. TELEPHONE SYSTEM; J. I. Sabin, San Francisco, Cal. Application filed June 14, 1894. This comprises a contact arm adapted to be moved over a series of terminals of an electro-magnet, a disk rotatable with the contact arm, a spring carried upon the polarized armature of an electromagnet, and means for reversing the direction of current through the magnet to cause the first named magnet to be shunted.

529,484. PRINTING TELEGRAPH; B. A. Fiske, U. S. Navy. Application filed October 13, 1888. This comprises a shaft, a type wheel connected thereto, arms loosely mounted upon the shaft, a latch, adjuster magnet, and a curved extension of the armature lever of the magnet.

529,532. SWITCHING APPARATUS FOR INCANDESCENT ELECTRIC LAMPS; C. E. Scribner, Chicago, Ill. Application filed April 3, 1889. This comprises a translating device, a pair of switches, each provided with two contact points united by circuit connections, movable contact making members adapted to close circuit through the contact points, the members being connected respectively directly to the opposite mains of the source of electricity.

529,552. TROLLEY STAND; F. N. Kelsey, New Haven, Conn. Application filed August 29, 1894. The combination with a pivotally supported socket piece for receiving the trolley arm, of a spring actuated controlling device which engages a portion of the socket piece and is eccentric to the path of movement of the part which it engages.

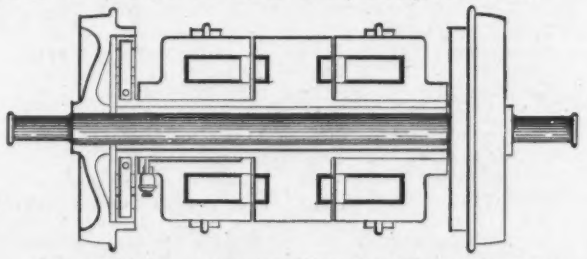
529,559. ELECTRIC CIRCUIT; J. W. Marsh, Pittsburg, Pa. Application filed April 10, 1894. This consists of a pair of conductors, one conductor having a water-proof insulation and the other conductor a non-waterproof insulation of lower specified inductive capacity, the separately insulated conductors lying side by side, whereby the conductors are separated by both insulations.

529,563. APPARATUS FOR GENERATING ELECTRICITY FOR LIGHTING RAILWAY CARS; T. A. Murray, Boston, Mass. Application filed May 3, 1894. The combination with a dynamo located below the car body, of a support for the dynamo located below and separated from the car body and mounted to be turned in a substantially vertical plane.

529,578. SWITCH; F. B. Badt, Chicago, Ill. Application filed October 14, 1892. This comprises an air-tight chamber, terminals therein, and a conducting fluid in the chamber adapted to cover both terminals when the chamber is swung in a determined position.

529,595. ELECTRIC SWITCH AND CUT-OUT. J. C. Cassidy, East Orange, N. J. Application filed September 24, 1894. This comprises a frame having an insulating block provided with a contact face thereon, and a revolving wheel having contact springs adapted to make contact with the contact face when the wheel is rotated.

529,609. ANTISEPTIC MOUTHPIECE FOR TELEPHONES; R. N. Dennison and F. M. Geary, Brooklyn, N. Y. Application filed April 25, 1894. A mouthpiece containing an antiseptic material and provided with vents leading from the material to the interior of the mouthpiece.



No 529,671.—Gearless Electric Locomotive.

529,616. SECTION INSULATOR; A. Hennefeld, C. Dehner and C. H. Van Ness, Colorado Springs, Col. Application filed April 19, 1894. The combination of a curved bar of insulating material provided with metallic tips, a perforated insulating bar secured to the main bar and adapted to receive loops formed on the ends of the trolley wire, clamping plates for holding the wire in place in the bar, and clamps for fastening the loops at the end of the trolley wire.

529,630. PRINTING TELEGRAPH; G. A. Scott, London, England. Application filed September 6, 1887. The combination of a type wheel, a flexible connection connected to the type wheel to operate the same, a securing device for one end of the flexible connection, and a series of magnets the armatures of which operate upon the flexible connection to move the type wheel.

529,650. CONTINUOUS CURRENT DYNAMO ELECTRIC MACHINE; M. Hutin and M. Leblanc, Paris, France. Application filed February 12, 1894. A dynamo provided with one or more electrical circuits of low resistance, closed upon themselves and threading through the polar extensions of the field magnets.

529,654. ELECTRIC LIGHT FIXTURE; J. R. Konetshny, Brooklyn, N. Y. Application filed February 21, 1894. This comprises a lamp base, automatic reel secured within the base, flexible conductors passing around the reel and through an aperture in the base, and connected at their free ends with the lamp, together with a lamp holder attached to the lamp, the lamp holder being separable from the base and arranged to fit over and embrace the base carrying the reel.

529,671. GEARLESS ELECTRIC LOCOMOTIVE; C. J. Van Depoele, Lynn, Mass. Application filed June 3, 1891. An electric motor for cars mounted upon a sleeve surrounding the axle and sustained by springs secured to the wheels.